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OF THE

OUTHERN SURGICAL ASSOCIATION

VOLUME XXXIII

THIRTY-THIRD SESSION

HELD AT HOT SPRINGS, VIRGINIA.

DECEMBER, 14, 15 AND 16, 1920

EDITED BY H. A. ROYSTER, M.D.

PUBLISHED BY THE ASSOCIATION

1921

The Association does not hold itself responsible for the views enunciated in the papers and discussions published in this volume.

H. A. ROYSTER, M.D., *Secretary,*
RALEIGH, N. C.

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JAMES E. THOMPSON, Galveston, Texas.

WILLARD BARTLETT, St. Louis, Mo.

LIST OF OFFICERS

FROM THE ORGANIZATION TO THE PRESENT TIME.

* Deceased.

	President	Vice-Presidents	Secretary	Treasurer
1888.	*W. D. Haggard	R. D. Webb J. W. Sears	*W. E. B. Davis	Hardin P. Cochrane
1889.	*Hunter H. McGuire	*W. O. Roberts *Bedford Brown	*W. E. B. Davis	Hardin P. Cochrane
1890.	*George J. Engelmann	*Berthold E. Hadra Duncan Eve	*W. E. B. Davis	Hardin P. Cochrane
1891.	Lewis S. McMurtry	*J. McFadden Gaston J. T. Wilson	*W. E. B. Davis	Hardin P. Cochrane
1892.	*J. McFadden Gaston	*Cornelius Kollock *George Ben Johnston	*W. E. B. Davis	Hardin P. Cochrane
1893.	*Bedford Brown	*Joseph Price George A. Baxter	*W. E. B. Davis	Hardin P. Cochrane
1894.	*Cornelius Kollock	A. B. Miles J. B. S. Holmes	*W. E. B. Davis	Hardin P. Cochrane
1895.	*Louis McLane Tiffany	Ernest S. Lewis *Manning Simons	*W. E. B. Davis	*Richard Douglas
1896.	Ernest S. Lewis	*Joseph Taber Johnson *Richard Douglas	*W. E. B. Davis	*A. M. Cartledge
1897.	*George Ben Johnston	W. E. Parker *Floyd W. McRae	*W. E. B. Davis	*A. M. Cartledge
1898.	*Richard Douglas	*H. H. Mudd *James A. Goggans	*W. E. B. Davis	*A. M. Cartledge
1899	*Joseph Taber Johnson	F. W. Parham *W. L. Robinson	*W. E. B. Davis	*A. M. Cartledge
1900.	*A. M. Cartledge	*Manning Simons W. P. Nicolson	*W. E. B. Davis	W. D. Haggard
1901.	*Manning Simons	George H. Noble *L. C. Bosher	W. D. Haggard	*Floyd W. McRae
1902.	*W. E. B. Davis	J. Wesley Bovée J. W. Long	W. D. Haggard	*Floyd W. McRae
1903.	J. Wesley Bovée	*Christopher Tompkins Bacon Saunders	W. D. Haggard	*Floyd W. McRae
1904.	*Floyd W. McRae	George S. Brown J. Shelton Horsley	W. D. Haggard	Charles M. Rosser
1905.	*Lewis C. Bosher	J. D. S. Davis I. S. Stone	W. D. Haggard	Charles M. Rosser
1906.	George H. Noble	Stuart McGuire E. Denegre Martin	W. D. Haggard	Charles M. Rosser
1907.	Howard A. Kelly	Rufus E. Fort Hubert A. Royster	W. D. Haggard	Charles M. Rosser
1908.	F. W. Parham	*Henry D. Fry W. F. Westmoreland	W. D. Haggard	Stuart McGuire
1909.	Stuart McGuire	*John Young Brown R. S. Cathcart	W. D. Haggard	Wm. S. Goldsmith
1910.	*W. O. Roberts	Joseph C. Bloodgood Lewis C. Morris	W. D. Haggard	Wm. S. Goldsmith
1911.	Rudolph Matas	Guy L. Hunner J. Garland Sherrill	W. D. Haggard	Wm. S. Goldsmith
1912.	J. M. T. Finney	J. E. Thompson W. P. Carr	W. D. Haggard	Wm. S. Goldsmith
1913.	*John Young Brown	*Ap Morgan Vance Lomax Gwathmey	W. D. Haggard	Le Grand Guerry
1914.	John W. Long	A. C. Scott James F. Mitchell	W. D. Haggard	Le Grand Guerry
1915.	Bacon Saunders	Thomas S. Cullen S. M. D. Clark	W. D. Haggard	Le Grand Guerry
1916.	Thomas S. Cullen	Robert S. Hill Willard Bartlett	W. D. Haggard	Le Grand Guerry
1917.	W. D. Haggard	J. Ernest Stokes F. R. Hagner	H. A. Royster	Le Grand Guerry
1918.	Isaac S. Stone	Le Grand Guerry Carey P. Rogers	H. A. Royster	Guy L. Hunner
1919.	James E. Thompson	Charles R. Robins George A. Hendon	H. A. Royster	Guy L. Hunner
1920.	Willard Bartlett	C. Jeff Miller Edward G. Jones	H. A. Royster	Guy L. Hunner
1921.	Randolph Winslow	Hugh H. Trout James N. Baker	H. A. Royster	Guy L. Hunner

LIST OF MEETING PLACES, WITH DATES AND PRESIDING OFFICERS

1888.	Birmingham,	William D. Haggard
1889.	Nashville,	Hunter H. McGuire
1890.	Atlanta,	George J. Engelmann
1891.	Richmond,	Lewis S. McMurtry
1892.	Louisville,	J. McFadden Gaston
1893.	New Orleans,	Bedford Brown
1894.	Charleston,	Cornelius Kollock
1895.	Washington,	Louis McLane Tiffany
1896.	Nashville,	Ernest S. Lewis
1897.	St. Louis,	George Ben Johnston
1898.	Memphis,	Richard Douglas
1899.	New Orleans,	Joseph Taber Johnson
1900.	Atlanta,	A. M. Cartledge
1901.	Richmond,	Manning Simons
1902.	Cincinnati,	W. E. B. Davis
1903.	Atlanta,	J. Wesley Bovée
1904.	Birmingham,	Floyd W. McRae
1905.	Louisville,	Lewis C. Bosher
1906.	Baltimore,	George H. Noble
1907.	New Orleans,	Howard A. Kelly
1908.	St. Louis,	F. W. Parham
1909.	Hot Springs,	Stuart McGuire
1910.	Nashville,	William O. Roberts
1911.	Washington,	Rudolph Matas
1912.	Old Point,	John M. T. Finney
1913.	Atlanta,	John Young Brown
1914.	Asheville,	John W. Long
1915.	Cincinnati,	Bacon Saunders
1916.	White Sulphur Springs,	Thomas S. Cullen
1917.	St. Augustine,	William D. Haggard
1918.	Baltimore,	Isaac S. Stone
1919.	New Orleans,	James E. Thompson
1920.	Hot Springs,	Willard Bartlett

HONORARY FELLOWS

Founder.—*Cunningham, Russell M.	Ensley, Ala.
Founder.—Davis, John D. S.	Birmingham, Ala.
1894.—Foy, George	Dublin.
1894.—Jacobs, Charles	Brussels.
1914.—*Johnson, Joseph Taber	Cherrydale, Va.
1910.—Jones, Robert	Liverpool.
1910.—Lane, Arbuthnot	London.
1917.—Lewis, Ernest S.	New Orleans, La.
Founder.—Long, John Wesley	Greensboro N. C.
1917.—McMurtry, Lewis S.	Louisville, Ky.
1894.—Martin, A.	Berlin.
1902.—Maury, Richard B.	Memphis, Tenn.
1894.—Morisani, O.	Naples.
1910.—Morison, Rutherford	New-Castle-on-Tyne.
1910.—Moynihan, B. G. A.	Leeds.
1910.—Myles, Thomas, Sir	Dublin.
1910.—Robson, Mayo	London.
1910.—Stiles, H. J.	Edinburgh.
Founder.—Stone, Isaac S.	Washington, D. C.
Founder.—Taylor, Hugh M.	Richmond, Va.
1917.—Tuholske, Herman	St. Louis, Mo.
1920.—Vander Veer, Albert	Albany, N. Y.

* Deceased

FELLOWS

1908.—Abell, Irvin, M.D. Professor of Principles and Practice of Surgery and Clinical Surgery, Medical Department, University of Louisville; Visiting Surgeon, Louisville City Hospital; President of Staff, St. Joseph's Infirmary; Consultant to Staff, Children's Free Hospital. 700 Francis Building, Louisville, Ky.

1911.—Allen, Carroll W., M.D. 43 Audubon Boulevard, New Orleans, La.

1915.—Baer, William Stevenson, A.B., M.D. Associate Professor of Clinical Orthopedic Surgery, Johns Hopkins University; Associate in Orthopedic Surgery in charge of Orthopedic Department, Johns Hopkins Hospital; Consulting Orthopedic Surgeon, Home for Incurables; Surgeon-in-chief, Children's Hospital; Visiting Orthopedic Surgeon, Union Protestant Infirmary, Hospital for Women of Maryland, and Robert Garrett Hospital for Children; Consulting Orthopedic Surgeon, Cambridge Hospital, Cambridge, Md., and Sheppard and Enoch Pratt Hospital, Towson, Md. 4 East Madison Street, Baltimore, Md.

1917.—Bagley, Charles, Jr., A.B., M.D. Associate in Experimental Neurology Johns Hopkins University. The Latrobe, Baltimore, Md.

1914.—Bailey, Fred. Warren, B.S., M.D. Associate Professor of Surgery, St. Louis University School of Medicine; Surgeon, St. John's Hospital; Visiting Surgeon, St. Louis City Hospital; Consulting Surgeon, American Car and Foundry Co. 611 Metropolitan Building, St. Louis, Mo.

1905.—Baker, James Norment, M.D. Attending Surgeon, Highland Park Sanitarium; Local Surgeon, A. C. L. Railroad. *Vice-President.* 602 S. Perry Street, Montgomery, Alabama.

1916.—Balfour, Donald Church, M.D. Surgeon to St. Mary's Hospital. Rochester, Minn.

1916.—Barksdale, John W., M.D. Winona, Miss.

1908.—Barr, Richard Alexander, M.D. Professor of Surgery and Clinical Surgery, Medical Department of Vanderbilt University; Major and Surgeon of First Tennessee Infantry, U. S. A., Spanish American War and Phillipine Insurrection; Late Lieut.-Col., M.C., U. S. A. (Hospital Unit "S"). 800 Nineteenth Avenue, S., Nashville, Tenn.

1905.—Barrow, David, M.D. Ex-President Kentucky State Medical Society. 148 Market Street, Lexington, Ky.

1905.—Bartlett, Willard, A.B., A.M., M.D. Associate in Clinical Surgery, Washington University; Demonstrator of Pathological Anatomy, University of Berlin, 1896–97; Voluntary Assistant, University of Strassburg, 1897–98; Professor of Pathology, Marion-Sims College of Medicine, 1898–1901; Demonstrator and Professor of Experimental Surgery, Washington University Medical School, 1901–12; Chairman of the Surgical Staff, St. Louis City Hospital, 1910–12; Surgeon, Missouri Baptist Sanitarium. *Vice-President,* 1916; *President,* 1920. 410 Metropolitan Building, St. Louis, Mo.

1901.—Baughman, Greer, M.D. Professor of Obstetrics, Medical College of Virginia; Visiting Obstetrician to the Virginia Hospital, Memorial Hospital, and Stuart Circle Hospital, 26 North Laurel Street, Richmond, Virginia.

1920.—Beall, Frank Cooke, B.S., M.D. Surgeon-in-Charge, the Johnson-Beall Hospital. 703 Lamar Street, Fort Worth, Texas.

1917.—Bell, Richard Phillips, B.A., M.D. Chief of Staff, King's Daughters Hospital. 202 Professional Building, Staunton, Va.

1916.—Biggs, Montgomery Herman, M.D. Surgeon to Rutherford Hospital; Chief Surgeon C. C. and O. Railway. Rutherfordton, N. C.

1916.—Black, William T., M.D. Associate Professor of Gynecology, University of Tennessee; Visiting Gynecologist to St. Joseph's and Baptist Memorial Hospitals; Associate Visiting Gynecologist, Memphis General Hospital; President of Staff and Visiting Surgeon, Porter Home and Leath Orphan Asylum. Exchange Building, Memphis, Tenn.

1908.—Blair, Vilray Papin, A.M., M.D. Metropolitan Building, St. Louis, Mo.

1906.—Bloodgood, Joseph Colt, M.D. Associate Professor of Surgery, Johns Hopkins University; Associate Surgeon, Johns Hopkins Hospital; Surgeon to the Union Protes-

tant Infirmary; Chief Surgeon to St. Agnes' Hospital. *Vice-President*, 1910. 904 North Charles Street, Baltimore, Md.

1920.—Boland, Frank Kells, A.B., M.D. Professor of Clinical Surgery, Emory University; Surgeon to the Grady, the Wesley Memorial, and the Georgia Baptist Hospitals. Candler Building, Atlanta, Ga.

1901.—Boldt, Hermann J., M.D. Consulting Gynecologist to Post-Graduate Hospital, Beth Israel Hospital, Stuyvesant Polyclinic, Union Hospital, and St. Vincent's Hospital; Professor Emeritus of Gynecology, Post-Graduate Medical School and Hospital; Honorary Fellow of the American Gynecological Society; Member of the Gynecological Society of Germany; Fellow of the Royal Society of Medicine (London); ex-President of the New York Obstetrical Society; of the German Medical Society of New York; of the Section of Obstetrics and Gynecology of the New York Academy of Medicine. 616 Madison Avenue, New York, N. Y.

1902.—Bonifield, Charles Lybrand, M.D. Professor of Gynecology, Medical Department University of Cincinnati; Member and ex-President, American Association of Obstetricians and Gynecologists; ex-President, Cincinnati Academy of Medicine; ex-President, Cincinnati Obstetrical Society; ex-President, Ohio State Medical Association. 409 Broadway, Cincinnati, Ohio.

*1890.—Bosher, Lewis Crenshaw, M.D. Professor of Practice of Surgery and Clinical Surgery in the Medical College of Virginia; Visiting Surgeon to the Memorial Hospital; Member of American Surgical Association; Member of the American Association of Obstetricians and Gynecologists; Member of Association of American Anatomists; Member of American Urological Association; ex-President of Richmond Academy of Medicine and Surgery. *Vice-President*, 1901; *President*, 1905. 422 East Franklin Street, Richmond, Va.

1895.—Bovée, J. Wesley, M.D. Fellow and ex-President American Gynecological Society; President of Washington Obstetrical and Gynecological Society; ex-President Medical and Surgical Society of the District of Columbia; Honorary Fellow of Medical Society of Virginia; ex-Chairman of the Section of Gynecology, American Medical Association; Professor of Gynecology, George Washington University; Gynecologist to Columbia, and George Washington University Hospitals; Attending Gynecologist to St. Elizabeth's Hospital for the

Insane, Washington, D. C.; President, Medical Board, Woman's Welfare Association; Medical Member, Board of Trustees of the National Training School for Girls. *Vice-President*, 1902; *President*, 1903. The Rochambeau, Washington, D. C.

1908.—Bryan, Robert C., M.D. Professor of Genito-urinary Diseases, Medical College of Virginia; Visiting Surgeon to the Grace, the Memorial, and the Virginia Hospitals. Grace Hospital, Richmond, Virginia.

1910.—Bryan, W. A., M.D. Professor of Surgery and Clinical Surgery, Vanderbilt University; Professor of Oral Surgery, Dental Department, Vanderbilt University; Surgeon, Woman's Hospital, Nashville City Hospital, and Watauga Sanitarium. 146 Eighth Avenue, N., Nashville, Tenn.

1913.—Buist, A. Johnston, M.D. Professor of Gynecology, Medical College of the State of South Caroline; Visiting Gynecologist, Roper Hospital. 279 Meeting Street, Charleston, S. C.

1907.—Burch, Lucius E., M.D. Acting Dean and Professor of Gynecology, School of Medicine, Vanderbilt University; Gynecologist, Woman's Hospital and Vanderbilt University Hospital; Chief Surgeon, Tennessee Central Railroad; late Lieut.-Col., M.C., U. S. Army, A. E. F. 210 Doctor's Building, Nashville, Tenn.

1917.—Burnam, Curtis Field, A.B., M.D. Surgeon, Howard A. Kelly Hospital. 1418 Eutaw Place, Baltimore, Md.

1902.—Caldwell, C. E., A.M., M.D. Professor of Clinical Surgery and Surgical Anatomy in Medical Department, University of Cincinnati; Surgeon to Cincinnati General Hospital. "The Livingston," Seventh and Race Streets, Cincinnati, Ohio.

1910.—Caldwell, Robert, M.D. Professor of Surgical Anatomy, Vanderbilt University; Surgeon to St. Thomas' Hospital. 510 Jackson Building, Nashville, Tenn.

1906.—Cannaday, John Egerton, M.D. Visiting Surgeon, Charleston General, and St. Francis Hospitals. Kanowha Banking and Trust Co. Building, Charleston, W. Va.

1904.—Carothers, Robert, M.D. Surgeon to the Good Samaritan and Children's Hospitals. 409 Broadway, Cincinnati, Ohio.

1903.—Carr, William P., M.D. Professor of Clinical Surgery, Columbian University; Consulting Surgeon to the Emergency Hospital and University Hospital; Consulting Surgeon to the Washington Asylum Hospital and the Government

Hospital for the Insane, Washington, D. C. *Vice-President,* 1912. 1801 K Street, N. W., Washington, D. C.

1899.—Cathcart, R. S., M.D. Professor of Abdominal Surgery, Medical College of the State of South Carolina; Surgeon-in-chief, Roper Hospital, Charleston, S. C.; Surgeon, Atlantic Coast Line Railway, Charleston Consolidated Railway and Lighting Co., The Citadel—the Military College of South Carolina, and the Confederate Home College, Charleston, S. C. *Vice-President,* 1909. 75 Hasell Street, Charleston, South Carolina.

1907.—Clark, John G., M.D. Professor of Gynecology, University of Pennsylvania; Gynecologist-in-Chief, University Hospital. 2017 Walnut Street, Philadelphia, Penna.

1907.—Clark, S. M. D., M.D. Professor of Gynecology and Clinical Obstetrics, Tulane Medical Department; Visiting Surgeon, Charity Hospital. 1435 Harmony Street, New Orleans Louisiana.

1919.—Clopton, Malvern Bryan, M.D. Associate in Surgery, Washington University Medical School; Visiting Surgeon, St. Luke's Hospital; Associate Surgeon, Barnes Hospital and Children's Hospital. Humboldt Building, St. Louis, Missouri.

1893.—Cocram, Henry S., M.D. 108 Baronne Street, New Orleans, La.

1908.—Coffey, Robert C., M.D. Secretary, Oregon State Board of Medical Examiners; Councillor, Oregon State Medical Association. Stevens Building, Portland, Oregon.

1909.—Cole, Herbert Phalon, M.D. Van Antwerp Building, Mobile, Ala.

1916.—Coleman, Claude C., M.D. Professor of Oral Surgery and Anesthesia; Associate Professor in Operative Surgery, Medical College of Virginia; Attending Surgeon, Hospital Division, Medical College of Virginia. 503 Professional Building, Richmond, Va.

1902.—Coley, William B., M.D. Professor of Clinical Cancer Research, Cornell University Medical College; Attending Surgeon to Hospital for Ruptured and Crippled, and Memorial Hospital. 6 West Fiftieth Street, New York, N. Y.

1914.—Cousins, William Lewis, M.D. Surgeon-in-Chief, St. Barnabas' Hospital; Consulting Surgeon, Maine General Hospital. 231 Woodford Street, Portland, Maine.

1916.—Cowden, Charles N., M.D. Surgeon to City Hospital; Gynecologist to St. Thomas' Hospital. Hitchcock Bldg., Nashville, Tenn.

1907.—Crawford, Walter W., M.D. Ex-President, Southern Medical Association; ex-President, Mississippi State Medical Association; Surgeon to South Mississippi Infirmary; Lieut.-Col., M.C., U. S. Army; Chief Surgical Service, Base Hospital, Camp Shelby, 1917–18; Chief Surgical Service, Base Hospital 79, 1918–19. Hattiesburg, Miss.

1902.—Crile, George W., M.D. Professor of Surgery, The School of Medicine of Western Reserve University; Visiting Surgeon to Lakeside Hospital. 1021 Prospect Avenue, Cleveland, Ohio.

1908.—Crisler, Joseph Augustus, B.S., M.D. Exchange Building, Memphis, Tenn.

1920.—Crook, Jere Lawrence, A.M., M.D. Owner and Chief Surgeon of the Crook Sanitarium; President of the Southern Medical Association (1921); Division Surgeon of the Illinois Central Railroad; Local Surgeon of the N. C. and St. L., and G. M. & N. Railroads; Surgeon for U. S. Government in the Marine Hospital Service. 110 W. Baltimore Street, Jackson, Tenn.

1917.—Cullen, Ernest K., M.B. Associate Professor of Gynecology, Detroit College of Medicine and Surgery; Attending Surgeon in Gynecology, Harper Hospital; Consultant Gynecologist, St. Mary's Hospital. David Whitney Building, Detroit, Mich.

1906.—Cullen, Thomas Stephen, M.B. Professor of Clinical Gynecology, Johns Hopkins University; Visiting Gynecologist, Johns Hopkins Hospital; Consultant in Abdominal Surgery, Church Home and Infirmary; Fellow of the American Gynecological Society; Honorary Member to La Societa Italiana Ostettricia Ginecologia, Rome; Corresponding Member of the Gesellschaft f. Geburtshülfe, Leipzig; Honorary Fellow of the Edinburgh Obstetrical Society. *Vice-President*, 1915; *President*, 1916. 20 E. Eager Street, Baltimore, Maryland.

1907.—Danna, Joseph A., M.D. Chief Visiting Surgeon, Charity Hospital. Charity Hospital, New Orleans, Louisiana.

1910.—Davis, John Staige, M.D. Associate in Clinical Surgery, Johns Hopkins University; Assistant Visiting and Dispensary Surgeon, Johns Hopkins Hospital; Visiting and Plastic Surgeon to the Union Memorial Hospital, the Hospital

for the Women of Maryland, and the Children's Hospital of Baltimore. The Severn, Baltimore, Md.

1900.—Deaver, John B., M.D. Surgeon-in-Chief to the Lankenau Hospital; John Rhea Barton Professor of Surgery, University of Pennsylvania; Surgeon to the Hospital of the University of Pennsylvania. 1634 Walnut Street, Philadelphia.

1896.—Doughty, W. H., M.D. Dean and Professor of Surgery, Medical Department, University of Georgia; Chief Surgeon to Charleston and Western Carolina, and Georgia and Florida Railroads, and Augusta-Aiken Railway and Electric Corporation; President of the Georgia State Board of Health. 822 Greene Street, Augusta, Ga.

1914.—Downes, William Augustus, M.D. Assistant Professor of Clinical Surgery, Columbia University, College of Physicans and Surgeons; Attending Surgeon, St. Luke's, Memorial and Babies' Hospitals; Consulting Surgeon, Manhattan State Hospital, Hospital for Ruptured and Crippled, New York, Infirmary for Women and Children, New York, United Hospital, Port Chester. 424 Park Avenue, New York, N. Y.

1916.—Du Bose, Francis Goodwin, M.D. Surgeon-in-Charge of Vaughan Memorial Hospital. Selma, Ala.

1890.—Earnest, John G., M.D. Consulting Gynecologist to the Grady Hospital; Professor Emeritus of Clinical Gynecology, Emory University; Member of the Surgical Staff, St. Joseph's Infirmary. 828 Candler Building, Atlanta, Ga.

1907.—Elbrecht, O. H., M.D. Visiting Surgeon, St. Louis City Hospital; Consulting Surgeon to St. Louis Maternity, Bethesda and Missouri Pacific Railroad Hospitals. 423 Metropolitan Building, St. Louis, Mo.

1891.—Elkin, William Simpson, M.D. Dean and Professor of Gynecology in the School of Medicine, Emory University; ex-President of the Atlanta Society of Medicine; Consulting Surgeon to Grady Hospital; Gynecologist to Wesley Memorial Hospital. 1029 Candler Building, Atlanta, Ga.

1904.—Finney, J. M. T., M.D. Associate Professor of Surgery, Johns Hopkins University; Surgeon to Out-patients, Johns Hopkins Hospital. *President*, 1912. 1300 Eutaw Place, Baltimore, Md.

1920.—Fisher, William Alexander, Jr., M.D. Associate in Clinical Surgery, Johns Hopkins University; Assistant Visiting Surgeon, Johns Hopkins Hospital; Visiting Surgeon, Union Memorial Hospital, Church Home and Infirmary, Hos-

pital for the Women of Maryland, Children's Hospital School. 715 Park Avenue, Baltimore, Md.

1917.—Fletcher, Marshall H., M.D. Chief of Staff, Asheville Mission Hospital; Surgeon Clarence Barker Memorial Hospital and Dispensary, Biltmore. 199 Haywood Street, Asheville, N. C.

1901.—Fort, Rufus E., M.D. Surgeon to Tennessee Central Railroad; Visiting Surgeon, Nashville Protestant Hospital and Nashville City Hospital. *Vice-President,* 1907. 303 Seventh Avenue, N., Nashville, Tenn.

1905.—Frank, Louis, M.D. Professor of Surgery and Clinical Surgery, University of Louisville; Surgeon to Louisville City Hospital; Surgeon, Norton Memorial Infirmary; Consulting Surgeon, Children's Free Hospital. 400 Atherton Building, Louisville, Ky.

1916.—Frazier, Charles H., M.D. Professor of Clinical Surgery, University of Pennsylvania. 1724 Spruce Street, Philadelphia, Pa.

1902.—Freiberg, Albert H., M.D., LL.D. Professor of Orthopedic Surgery in the University of Cincinnati; Director of the Orthopedic Service, Cincinnati General Hospital; Orthopedic Surgeon to the Jewish Hospital of Cincinnati. Livingston Building, Cincinnati, Ohio.

1917.—Gerster, John C. A., M.D. Assistant Professor of Clinical Surgery, Cornell University Medical College. 18 East 78th St., New York, N. Y.

1917.—Gessner, Hermann B., A.M., M.D. Professor of Operative and Clinical Surgery in Tulane University; Chief Visiting Surgeon to Charity Hospital; Junior Surgeon to Touro Infirmary. 1105 Maison Blanche, New Orleans, La.

1920.—Gibbon, John H., M.D. Professor of Surgery, Jefferson Medical College; Surgeon to the Pennsylvania and Jefferson Hospitals; Consulting Surgeon, Bryn Mawr Hospital; Col., Medical Reserve Corps, U. S. A. 1608 Spruce Street, Philadelphia, Pa.

1913.—Gibbon, Robert L., M.D. Charlotte, N. C.

1918.—Gilcreest, Edgar L., A.B., M.D. 3698 California St., San Francisco, Cal.

1900.—Goldsmith, W. S., M.D. *Treasurer,* 1909–1912. 262 Jackson Street, Atlanta, Ga.

*1892.—Grant, Horace H., M.D. Professor of Surgery in the Hospital College of Medicine; Surgeon to the Louisville City Hospital. 328 Atherton Building, Louisville, Ky.

1905.—Guerry, Le Grand, M.D. Surgeon, Columbia Hospital. *Treasurer*, 1913–1918. *Vice-President*, 1918. Columbia, S. C.

1896.—Gwathmey, Lomax, M.D. Attending Surgeon, Norfolk Protestant Hospital, Out-patient Department; Consulting Surgeon, Parish Memorial and U. S. P. H. Hospitals; Co-proprietor, St. Christopher's Hospital. *Vice-President*, 1913. Norfolk, Va.

1896.—Haggard, William David, M.D. Professor of Surgery and Clinical Surgery, Vanderbilt University; Surgeon to St. Thomas' Hospital. *Treasurer*, 1900; *Secretary*, 1901–1916; *President*, 1917. 706 Church Street, Nashville, Tenn.

1910.—Hagner, Francis Randall, M.D. Professor of Genito-urinary Surgery, George Washington University; Attending Genito-urinary Surgeon, George Washington University Hospital; Attending Surgeon, Garfield Memorial Hospital. *Vice-President*, 1917. The Farragut, Washington, D. C.

1892.—Hall, Rufus Bartlett, A.M., M.D. Emeritus Professor of Gynecology and Clinical Gynecology, Ohio-Miami Medical College, Medical Department, University of Cincinnati; Surgeon-in-Charge of the Hall Hospital; ex-President of the American Association of Obstetricians and Gynecologists; ex-President of the Ohio State Medical Society; Member of the British Medical Society; ex-President of the Cincinnati Academy of Medicine; ex-President of the Cincinnati Obstetrical Society; Member of the American Medical Association. 628 Elm Street, Cincinnati, Ohio.

1910.—Hanes, Granville S., M.D. Professor of Diseases of the Rectum, Medical Department of the University of Louisville; Surgeon to the Louisville Public Hospital, John N. Norton Memorial Infirmary. Francis Building, Louisville, Ky.

1896.—Heflin, Wyatt, M.D. Gynecologist to the Hillman Hospital; Member of Surgical Staff of South Highlands Infirmary 3216 Cliff Road, Birmingham, Ala.

1917.—Helms, John Sullivan, A.B., M.D. Chief of Staff and Director Division of Surgery, the Bayside Hospital; Chief Surgeon, Tampa Children's Home; Consulting Surgeon, Gordon Keller Memorial Hospital. Tampa, Fla.

1905.—Hendon, George A., M.D. Professor of Surgery and Clinical Surgery, University of Louisville; Surgeon, St. Anthony's Hospital, Louisville City Hospital. *Vice-President.* 546 Francis Building, Louisville, Ky.

1918.—Henson, James W., M.D. Associate Professor of Surgery, Medical College of Virginia; Member of Surgical Staff of Virginia and Memorial Hospitals; Surgeon to the Southern Railway. 405 N. Allen Avenue, Richmond, Va.

1889.—Hill, Robert Somerville, M.D. Surgeon to the Laura Hill Hospital; Life Councillor, Medical Association of the State of Alabama; Member of the Alabama State Board of Health; ex-President of the Montgomery County Medical Association; former Surgeon of the Second Regiment, Alabama State Militia. *Vice-President*, 1916. Montgomery, Ala.

1913.—Hodgson, Fred G., M.D. Professor of Orthopedic Surgery, Medical Department, Emory University; Orthopedic Surgeon to Grady, Wesley Memorial, Georgia Baptist, and Mac Vicar Hospitals. 746 Peachtree Street, Atlanta, Ga.

1911.—Hogan, Edgar P., M.D. Associate Professor of Gynecology and Abdominal Surgery, Graduate School of Medicine of the University of Alabama; Resident Surgeon and Gynecologist to the Hillman Hospital. 412–14 Empire Building, Birmingham, Ala.

1906.—Holden, Gerry R., M.D. Formerly House Surgeon, Roosevelt Hospital, New York City; formerly Resident Gynecologist, Johns Hopkins Hospital, and Assistant in Gynecology, Johns Hopkins Medical School. 513 Laura Street, Jacksonville, Fla.

1900.—Horsley, John Shelton, M.D. Surgeon-in-Charge, St. Elizabeth's Hospital. *Vice-President*, 1904. 617 West Grace Street, Richmond, Va.

1903.—Hunner, Guy Le Roy, M.D. Associate in Gynecology, Johns Hopkins University; Consulting Gynecologist; Frederick City Hospital, Frederick, Md., and Hagerstown Hospital, Hagerstown, Md.; Visiting Gynecologist, the Johns Hopkins Hospital, Church Home, Hebrew Hospital, Hospital for the Women of Maryland, and Union Memorial Hospital. *Vice-President*, 1911. *Treasurer*. 2305 St. Paul Street, Baltimore, Md.

1900.—Ill, Edward Joseph, M.D. Gynecologist and Medical Director Emeritus, St. Michael's Hospital; Gynecologist and Supervising Obstetrician Emeritus, Hospital of St. Barnabas; Consulting Gynecologist, Newark Beth Israel Hospital, Newark City, Newark Memorial, and St. James Hospitals, Newark; Mountainside Hospital, Montclair; St. Elizabeth's Hospital, Elizabeth; Somerset Hospital, Somerville; Muhlen-

berg Hospital, Plainfield; Perth Amboy City Hospital, Perth Amboy; Stumpf Memorial Hospital, Kearney; All Souls' and Morristown Hospitals, Morristown; New Jersey State Village for Epileptics, Skillman. 1002 Broad Street, Newark, N. J.

1912.—Jackson, William R., M.D. Consulting Surgeon to Southern Infirmary, Mobile, Ala. 164 St. Michael Street, Mobile, Ala.

1908.—Jonas, Ernst, M.D. Clinical Professor of Surgery, Medical Department, Washington University; Chief of Surgical Clinic, Washington University Hospital; Gynecologist to the Jewish Hospital; Surgeon to the Martha Parsons Hospital for Children; Fellow of the American Association of Obstetricians and Gynecologists. 4495 Westminster Place, St. Louis, Missouri.

1910.—Jones, Edward Groves, A.B., M.D. Professor of Surgery, Medical Department, Emory University (Atlanta Medical College); Surgeon to Grady Memorial Hospital, Georgia Baptist Hospital and Wesley Memorial Hospital. *Vice-President,* 1920. 714 Hurt Building, Atlanta, Ga.

1902.—Jordan, William Mudd, M.D. 915 Empire Building, Birmingham, Ala.

1912.—Judd, Edward Starr, M.D. Surgeon to Mayo Clinic, Rochester, Minn.

1890.—Kelly, Howard Atwood, M.D. Founder of Kensington Hospital, Philadelphia; Associate Professor of Obstetrics, University of Pennsylvania, 1888–89; Professor of Gynecology and Obstetrics, Johns Hopkins University, 1889–99; Emeritus Professor of Gynecology, Johns Hopkins University; Consulting Gynecologist to Johns Hopkins Hospital; Membre Associé Etranger de la Société Obstétricale et Gynécologique de Paris; Correspondirendes Mitglied der Gesellschaft f. Geburtshülfe zu Leipzig; Honorary Fellow, Edinburgh Obstetrical Society, Royal Academy of Medicine (Ireland), and British Gynecological Society; Member of Washington Academy of Sciences; Fellow of the American Gynecological Society; Commander of the Order of Leopold II (1920). *President,* 1907. 1418 Eutaw Place, Baltimore, Maryland.

1917.—Kerr, Harry Hyland, M.D., C.M. Clinical Professor of Surgery, George Washington University Medical School; Attending Surgeon Garfield Memorial and Children's Hospitals; Consulting Surgeon, Providence Hospital. 1742 N. St., N. W., Washington, D. C.

1907.—Kirchner, Walter C. G., M.D. Formerly Surgeon-in-Charge, St. Louis City Hospital; Visiting Surgeon, City Hospital; Consulting Surgeon, St. John's Hospital. Metropolitan Building, 508 N. Grand Avenue, St. Louis, Mo.

*1899.—Kohlman, William, M.D. 3500 Prytania Street, New Orleans, La.

1914.—Landry, Lucian H., M.D. Demonstrator of Operative Surgery and Assistant Professor of Clinical Surgery, Tulane University of Louisiana, School of Medicine; Senior Associate in Surgery, Touro Infirmary; Visiting Surgeon, Charity Hospital. 2255 St. Charles Avenue, New Orleans, La.

1913.—LaRoque, G. Paul, M.D. Associate Professor of Surgery, Medical College of Virginia; Surgeon, Memorial Retreat, Dooley, St. Philip, Virginia, and Sheltering Arms Hospitals. 603 East Grace Street, Richmond, Va.

1916.—Law, Arthur Ayer, M.D. Associate Professor of Surgery, University of Minnesota Medical School and Mayo Foundation; Lieut.-Col., M.C., U. S. Army, Commanding Base Hospital No. 26 in A. E. F.; Surgeon, University of Minnesota Hospital and University Hospital; Assistant Chief of University Hospital. Syndicate Building, Minneapolis, Minn.

1917.—Ledbetter, Samuel L., Jr., M.D. Visiting Surgeon, St. Vincent's Hospital; Associate Surgeon, Hillman Hospital. 516 Empire Building, Birmingham, Ala.

1894.—Leigh, Southgate, M.D. Surgeon and Gynecologist, Sarah Leigh Hospital and Clinic; Chief Surgeon, Virginian Railway Co.; Consulting Surgeon, S. A. L. Railway; Surgeon, N. & W., Penn., C. & O. and A. C. L. Railways; ex-President, Norfolk County Medical Society, Medical Society of Virginia; Tri-State Medical Association, Seaboard Medical Association, A. C. L. Railway Surgeons' Association, N. & W. Railway Surgeons Association, C. & O. Railway Surgeons Association, Southern States Association Railway Surgeons. 109 College Place, Norfolk, Va.

1912.—Lewis, Bransford, M.D. Century Building, St. Louis, Mo.

1914.—Lewis, Dean, A.B., M.D. Professor of Surgery, Rush Medical College; Attending Surgeon, Presbyterian Hospital; Consulting Surgeon, Anne W. Durand Hospital. 122 South Michigan Avenue, Chicago, Ill.

1900.—Lloyd, Samuel, M.D. Emeritus Professor of Surgery, New York Post-Graduate Medical School; Attending

Surgeon to the Lutheran Hospital; Consulting Surgeon to the Post-Graduate Hospital, St. Francis Hospital, Italian Hospital, St. Mary's Hospital (Orange, N. J.), St. Francis Hospital, (Poughkeepsie, N. Y.) and to the Benedictine Sanitarium, (Kingston, N. Y.) 50 East Forty-second St., New York, N. Y.

1904.—Lupton, Frank A., M.D. 816 Woodward Building, Birmingham, Ala.

1902.—McAdory, Wellington P., M.D. Surgeon to Hillman Hospital. Birmingham, Ala.

1911.—McGlannan, Alexius, M.D. Professor of Surgery, University of Maryland, and College of Physicians and Surgeons, Baltimore. 115 West Franklin St., Baltimore, Md.

1893.—McGuire, Stuart, M.D. Professor of Surgery, Medical College of Virginia; Surgeon-in-Charge, St. Luke's Hospital; Visiting Surgeon to the Memorial and Allied Hospitals. *Vice-President,* 1906; *Treasurer,* 1908; *President,* 1909. 513 East Grace Street, Richmond, Va.

1891.—McGuire, W. Edward, M.D. Professor of Gynecology, University College of Medicine; Gynecologist to the Virginia Hospital. 411 East Grace Street, Richmond, Va.

*1888.—McRae, Floyd Wilcox, M.D. Professor of Gastro-intestinal, Rectal, and Clinical Surgery, Atlanta College of Physicians and Surgeons; Surgeon to Grady Hospital; ex-President Medical Association of Georgia; ex-Secretary of Section on Surgery and Anatomy, American Medical Association. *Vice-President,* 1897; *Treasurer,* 1901–1903; *President,* 1904. Peters Building, Atlanta, Ga.

1905.—MacLean, Henry Stuart, M.D. Surgeon, Grace Hospital; Visiting Surgeon, Memorial Hospital. 401 West Grace Street, Richmond, Va.

1915.—Maes, Urban, M.D. Professor of Clinical and Operative Surgery, School of Medicine, Tulane University of Louisiana; Visiting Surgeon, Charity Hospital; Senior Associate in Surgery, Touro Infirmary; Surgical Consultant, United States Marine Hospital, New Orleans. 1671 Octavia Street, New Orleans, La.

1912.—Malone, Battle, M.D. 624 Exchange Building, Memphis, Tenn.

1891.—Marcy, Henry Orlando, A.M., M.D., LL.D. Surgeon to the Private Hospital for Women, Cambridge; ex-President of the American Medical Association; President of the Section on Gynecology, Ninth International Medical Congress;

late President of the American Academy of Medicine; Member of the British Medical Association, Massachusetts Medical Society, Boston Gynecological Society; Fellow of the American College of Surgeons; Corresponding Member of the Medico-Chirurgical Society of Bologna, Italy; late Surgeon, U. S. A. 180 Commonwealth Avenue, Boston, Mass.

1899.—Martin, E. Denegre, M.D. Professor of Surgery, Post-Graduate Department, Tulane Medical College; Visiting Surgeon to Charity Hospital. *Vice-President,* 1906. 3513 Prytania Street, New Orleans, La.

*1909.—Martin, Frank, M.D. Clinical Professor of Surgery at the University of Maryland. 1000 Cathedral Street, Baltimore, Md.

1913.—Martin, Franklin H., M.D. Professor of Gynecology, Post-Graduate School; Consulting Staff, St. Luke's Hospital. Editor, *Surgery, Gynecology and Obstetrics.* 30 North Michigan Avenue, Chicago, Ill.

1904.—Mason, J. M., M.D. Gynecologist to St. Vincent's Hospital; Surgeon to Hillman Hospital. 1915 Sixteenth Avenue, S., Birmingham, Ala.

1899.—Mastin, William M., M.D. Fellow of the American Surgical Association; Member of the American Association of Genito-urinary Surgeons; Surgeon to the Mobile City Hospital. Joachim and Conti Streets, Mobile, Ala.

1893.—Matas, R., M.D., LL.D. Professor of Surgery, School of Medicine, Tulane University; Senior, Department of Surgery, Touro Infirmary; Chief of Service, Surgical Division, Charity Hospital; ex-President, Louisiana State Medical Society, 1894–5; Vice-President, American Medical Association 1910. *President,* 1911. 3523 Prytania St., New Orleans, La.

1917.—Maury, John M., M.D. Professor of Gynecology, University of Tennessee, College of Medicine; Gynecologist, Memphis General and Baptist Memorial Hospitals. Bank of Commerce Building, Memphis, Tenn.

1902.—Mayo, Charles H., M.D., A.M., LL.D., D.Sc., F.R.C.S. (Eng.). Surgeon to the Mayo Clinic, St. Mary's Hospital; Professor of Surgery, Medical School, and of the Mayo Foundation, University of Minnesota. Rochester, Minn.

1898.—Miller, C. Jeff, M.D. Professor of Obstetrics and Clinical Gynecology, School of Medicine, Tulane University of Louisiana; Chief of the Division of Obstetrics and Gynecology, Charity Hospital; Chief of the Division of Gynecology, Touro

Infirmary; Professor of Abdominal Surgery, Post-Graduate School of Medicine, Tulane University; Member of the American Gynecological Society. *Vice-President,* 1920. 1638 Joseph Street, New Orleans, La.

1916.—Miller, Edward Howe, Jr., M.D. Surgeon, Danville General Hospital; Surgeon to Southern Railway; Surgeon to Providence Hospital. 6 Chestnut Place, Danville, Va.

1917.—Miller, Robert Talbott, Jr., M.D. Professor of Surgery, University of Pittsburgh Medical School; Surgeon to Mercy Hospital. Diamond Bank Building, Pittsburgh, Pa.

1907.—Mitchell, James F., M.D. Surgeon to Emergency Hospital. *Vice-President,* 1914. 1344 Nineteenth Street, Washington, D. C.

1901.—Mixter, Samuel Jason, M.D. Surgeon, Massachusetts General Hospital; Consulting Surgeon, Massachusetts Charity Eye and Ear Infirmary; Instructor of Surgery, Harvard Medical School. 180 Marlborough St., Boston, Mass.

1911.—Moore, John Thomas, M.D. Surgeon, St. Joseph's Infirmary, and Municipal Hospital. Kress Medical Bldg., Houston, Texas.

1904.—Moran, John F., M.D. Professor of Obstetrics, Georgetown University; Obstetrician to Georgetown University Hospital and Columbia Hospital for Women. 2426 Pennsylvania Avenue, Washington, D. C.

1902.—Morris, Lewis C., M.D. Professor of Gynecology and Abdominal Surgery, Graduate School of Medicine, University of Alabama; Gynecologist and Abdominal Surgeon, Hillman and St. Vincent's Hospitals; Surgeon, Children's Hospital; Consulting Surgeon, Employees Hospital, B. C. I. and Ry. Co.; Member, Jefferson County Medical Society, Medical Association, State of Alabama, American Medical Association, American Association of Obstetricians and Gynecologists. *Vice-President,* 1910. 1203–7 Empire Building, Birmingham, Ala.

1900.—Morris, Robert Tuttle, M.D. Emeritus Professor of Surgery, New York Post-Graduate Medical School and Hospital; Visiting Surgeon, Broad Street Hospital. 616 Madison Avenue, New York, N. Y.

1916.—Newell, E. Dunbar, M.D. Surgeon to the Newell Sanitarium; Consulting Surgeon to the Erlanger Hospital; Surgeon, C. N. O. & T. P., A. G. S., and Southern Railways; Surgeon, N. C. & St. L. and W. & A. Chattanooga, Tenn.

1889.—Nicolson, William Perrin, M.D. Surgeon and President, Medical Board, St. Joseph's Infirmary; Consulting Surgeon, Grady Memorial Hospital; ex-President of the Georgia Medical Association; ex-Secretary, Surgical Section, Pan-American Medical Congress. *Vice-President,* 1900. Healey Building, Atlanta, Ga.

1890.—Noble, George H., M.D., D.C.L. Professor of Clinical Gynecology, Atlanta Medical College; Gynecologist to Grady Hospital; Fellow of the American Gynecological Society and the American Association of Obstetricians and Gynecologists; ex-President of the Medical Association of Georgia; ex-Secretary of the Section of Obstetrics, American Medical Association. *Vice-President,* 1901; *President,* 1906. 186 South Pryor Street, Atlanta, Ga.

1920.—Noland, Lloyd, M.D. Chief Surgeon Tennessee Coal, Iron and Railroad Company Employees' Hospital. Birmingham, Ala.

1911.—Norris, Henry, M.D. Rutherfordton, N. C.

1901.—Ochsner, A. J., M.D., LL.D. Adjunct Professor of Clinical Surgery, College of Physicians and Surgeons; Surgeon-in-Chief, Augustana and St. Mary's Hospital. 2106 Sedgwick Street, Chicago, Ill.

1903.—Ochsner, Edward H., M.D. Surgeon to Augustana Hospital. 2155 Cleveland Avenue, Chicago, Illinois.

1902.—Oliver, John Chadwick, M.D. Acting Dean and Professor of Surgery, Medical College of the University of Cincinnati; Director of the Surgical Service, Cincinnati General Hospital; Surgeon to Christ Hospital. 628 Elm Street, Cincinnati, Ohio.

1888.—Parham, F. W., M.D. Professor of Surgery in the New Orleans Polyclinic; One of the Chief Surgeons, Touro Infirmary. *Vice-President,* 1899; *President,* 1908. 1429 Seventh Street, New Orleans, La.

1910.—Payne, Robert Lee, M.D. Surgeon to St. Vincent's Hospital, Southern Railway, Clyde and Chesapeake Steamship Companies; Consulting Surgeon, Seaboard Air Line Railway; Chief Surgeon, Norfolk-Southern Railroad, and Roanoke River Railway. Tazewell Building, Norfolk, Va.

1916.—Peck, Charles H., M.D. Professor of Clinical Surgery, Columbia University; Surgeon to Roosevelt Hospital; Consulting Surgeon to French, Ruptured and Crippled, and Memorial Hospitals. 30 W. Fiftieth Street, New York, N. Y.

1920.—Peple, W. Lowndes, M.D. Professor of Clinical Surgery, Medical College of Virginia; Chief of Surgical Services of the Memorial, Dooley and St. Philip Hospitals; Chairman of Staff and Chief of Surgical Service of the Virginia Hospital. 1209 W. Franklin St., Richmond, Va.

1899.—Perkins, W. M., M.D. Professor of Clinical Surgery, Post-Graduate Medical School, Tulane University; Instructor in Clinical Surgery, School of Medicine, Tulane University; Visiting Surgeon to the Charity Hospital. 830 Canal Street, New Orleans, Louisiana.

1908.—Peterson, Reuben, A.M., M.D. Professor of Obstetrics and Gynecology, University of Michigan; Obstetrician and Gynecologist-in-Chief to the University of Michigan Hospital. Ann Arbor, Mich.

1899.—Platt, Walter Brewster, M.D. Surgeon to the Robert Garrett Hospital for Children. 802 Cathedral Street, Baltimore, Md.

1917.—Pool, Eugene H., M.D. Consultant Surgeon to French Hospital, Port Chester Hospital, Central Islip State Asylum, New York Orthopedic Hospital, and Home for Incurables. 107 East Sixtieth Street, New York, N. Y.

1900.—Porter, Miles F., M.A., M.D. Surgeon to St. Joseph and Hope-Methodist Hospitals; Professor of Surgery, Indiana University School of Medicine. 2326 Fairfield Avenue, Fort Wayne, Ind.

*1900.—Ransohoff, Joseph, M.D., F.R.C.S. Professor of Anatomy and Clinical Surgery, University of Cincinnati; Surgeon to Cincinnati, Good Samaritan, and Jewish Hospitals; Member of American Surgical Association. 19 West Seventh Street, Cincinnati, Ohio.

1911.—Reder, Francis, M.D. Surgeon, St. Louis City and St. John's Hospitals. University Club Building, St. Louis, Mo.

1890.—Reed, Charles Alfred Lee, M.D. Ex-President of the American Medical Association; Professor of Gynecology and Abdominal Surgery in the Cincinnati College of Medicine and Surgery; Surgeon to the Cincinnati Free Hospital for Women; Fellow of the American Association of Obstetricians and Gynecologists; Fellow of the British Gynecological Society; ex-Chairman of the Section on Obstetrics and Diseases of Women of the American Medical Association; Secretary-General of the Pan-American Medical Congress, 1893; Honorary

Member of the Medical Society of the State of New York. 19 W. Seventh Street, Cincinnati, Ohio.

1914.—Rhodes, Goodrich Barbour, A.B., M.D. Associate Clinical Professor of Surgery, Medical College of the University of Cincinnati; Attending Surgeon, Cincinnati General Hospital and Episcopal Hospital for Children. The Ortiz, Fourth and Sycamore Streets, Cincinnati, Ohio.

1917.—Rhodes, Robert L., A.B., M.D. Associate in Surgery, Medical Department, University of Georgia; Visiting Surgeon, the Wilhenford Hospital; Assistant Visiting Surgeon, the University Hospital. 1103–5 Lamar Building, Augusta, Ga.

1919.—Richardson, Edward Henderson, A.B., M.D. Associate in Clinical Gynecology, Johns Hopkins University, Medical Department; Visiting Gynecologist, Union Protestant Infirmary, Church Home and Infirmary, Hebrew Hospital and Asylum, Bay View Hospital, Hospital for Women of Maryland; Assistant Visiting Gynecologist, Johns Hopkins Hospital. 1200 N. Charles St., Baltimore, Maryland.

1912.—Richardson, Edward P., M.D. Assistant Visiting Surgeon to the Massachusetts General Hospital. 224 Beacon Street, Boston, Mass.

*1888.—Roberts, William O., M.D. Professor of Principles of Surgery and Clinical Surgery, Medical Department of the University of Louisville; formerly Secretary of the Surgical Section of the American Medical Association. *Vice-President*, 1889; *President*, 1910. Atherton Building, Louisville, Ky.

1901.—Robins, Charles Russell, M.D. Professor of Gynecology, Medical College of Virginia; Surgeon, Stuart Circle Hospital; Gynecologist, Memorial Hospital; formerly Chief Surgeon to the Virginia Hospital; President, Stuart Circle Hospital Corporation. *Vice-President*, 1920. 8 West Grace Street, Richmond, Va.

1917.—Robinson, Julian McG., M.D. 753 Main Street, Danville, Va.

1906.—Rogers, Carey Pegram, M.D. Chief of Surgical Staff, St. Luke's Hospital; Consulting Surgeon, Seaboard Air Line Railway. *Vice-President*, 1918. 221 Laura Street, Jacksonville, Florida.

1901.—Rogers, Mack, M.D. Professor of Anatomy, Birmingham Medical College. 212 Twentieth Street, Birmingham, Alabama.

1901.—Rosser, Charles M., M.D. Professor of Surgery, Baylor University, College of Medicine; Consulting Surgeon, Parland Hospital; Attending Surgeon, Texas Baptist Memorial Sanitarium; President, Medical Association of the South West, 1907; ex-Vice-President, Texas State Medical Association; Vice-President, Tri-State Society of Texas, Louisiana, and Arkansas. *Treasurer*, 1904–07. 4002 Gaston Avenue, Dallas, Texas.

1899.—Royster, Hubert Ashley, A.B., M.D. Surgeon to Rex Hospital; Surgeon-in-Chief, St. Agnes' Hospital; Surgeon to Southern Railway. *Vice-President*, 1907. *Secretary*. 423 Fayetteville Street, Raleigh, N. C.

1909.—Ruffin, Kirkland, M.D. Surgeon-in-Charge of St. Christopher's Hospital. 218 York Street, Norfolk, Va.

1893.—Saunders, Bacon, M.D. Professor of Surgery, Baylor School of Medicine, Dallas, Texas; ex-President, Texas State Medical Association; Chief Surgeon, Fort Worth and Denver City and Wichita Valley Railway Companies. *Vice-President*, 1903; *Member of Council*, 1908–1913. *President*, 1915. Flatiron Bldg., Fort Worth, Texas.

1907.—Scott, Arthur Carroll, M.D. Senior Surgeon, Temple Sanatorium. *Vice-President*, 1914. Temple, Texas.

1915.—Seelig, Major G., A.B., M.D. Professor of Surgery, Washington University School of Medicine; Attending Surgeon, Jewish Hospital; Chief of Surgical Out-Patient Department, Jewish Hospital. University Club Building, St. Louis, Mo.

1899.—Shands, A. R., M.D. Professor of Orthopedic Surgery in the Medical Department of the George Washington University and in the University of Vermont; Orthopedic Surgeon to the George Washington University Hospital, the Emergency Hospital, and Central Dispensary; Charter Member, Washington Academy of Sciences; Member of American Orthopedic Association; and Honorary Member of Medical Society of Virginia. 901 Sixteenth Street, N. W., Washington, D. C.

1914.—Shands, Harley R., A.B., M.D. Visiting Surgeon, Mississippi State Charity and Baptist Hospitals. Century Building, Jackson, Miss.

1917.—Sherk, Henry H., M.D. Attending Surgeon, Pasadena Hospital; Surgeon, La Vina Sanitarium for the Tubercular. Central Building, Pasadena, Cal.

1902.—Sherrill, J. Garland, M.D. Professor of Surgery and Clinical Surgery, University of Louisville; Consulting

Surgeon to Louisville Hospital. *Vice-President*, 1911. Masonic Building, Louisville, Ky.

1900.—Simpson, Frank Farrow, M.D. Gynecologist to the Allegheny General Hospital. 7048 Jenkins Arcade Bldg., Pittsburgh, Pa.

1913.—Simpson, James Knox, M.D. Chief Surgeon, St. Luke's Hospital; Orthopedic Surgeon to Florida State Fund for Crippled Children. Jacksonville, Fla.

1920.—Singleton, Albert O., B.S., M.D. Associate Professor of Surgery, Medical Department, University of Texas, and Lecturer in Genito-urinary Diseases; Attending Surgeon to John Sealey Hospital. American National Insurance Building, Galveston, Texas.

1917.—Sistrunk, W. E., M.D. Mayo Clinic, Rochester, Minnesota.

1919.—Smyth, John, M.D. 724 Baronne St., New Orleans, Louisiana.

1899.—Smythe, Frank David, M.D. Gynecologist to St. Joseph's Hospital and President of the Staff; Lieut.-Col., Medical Corps, U. S. Army during the World War; ex-President, West Tennessee Medical and Surgical Society; formerly Member of the Board of Health and Examining Board of the State of Mississippi. 730–33 Exchange Building, Memphis, Tenn.

1916.—Souchon, Marion, M.D. Visiting Surgeon, Hotel Dieu; Surgeon, French Hospital; Assistant Professor of Clinical Surgery, Tulane University. Whitney Bank Bldg., New Orleans, La.

1904.—Stokes, James Ernest, M.D. *Vice-President*, 1917. Salisbury, N. C.

1918.—Stone, Harvey B., A.B., M.D. Instructor in Clinical Surgery, Johns Hopkins University; Assistant Visiting Surgeon, Johns Hopkins Hospital; Member of Staff, Union Memorial Hospital, Church Home and Infirmary, Mercy Hospital and Hebrew Hospital. 18 West Franklin St., Baltimore, Md.

1920.—Sullivan, Raymond Peter, A.B., A.M., M.D. Surgeon to St. Vincent's and Holy Family (Brooklyn) Hospitals; Consulting Surgeon, King's Park Hospital, King's Park, N. Y. 270 Park Avenue, New York, N. Y.

1894.—Talley, Dyer F., A.M., M.D. Surgeon-in-Chief of Talley's Private Infirmary; Attending Surgeon to Hillman Hospital; ex-President of the Jefferson County Medical Society; Member of the Medical Association of the State of Alabama,

of the Southern Medical Association, of the Alumni Association of the Charity Hospital of Louisiana, of the Board of Censors of the Jefferson County Medical Society, of the Board of Censors of the Committee of Health and Examining Board of the Medical Association of the State of Alabama; ex-Member of the Advisory Board for Selective Draft; Fellow of the American College of Surgeons. 1808 Seventh Avenue, Birmingham, Alabama.

1892.—Thompson, J. E., M.B., B.S. (London), F.R.C.S. (Eng.). Professor of Surgery in the University of Texas. *Vice-President*, 1912; *President*, 1919. Galveston, Tex.

1916.—Thorning, W. Burton, M.D. Chief Surgeon of the Gulf Coast Lines. Kress Building, Houston, Texas.

1908.—Torrance, Gaston, M.D. Member Surgical Staff Hillman Hospital; also the Sisters' Hospital and St. Vincent's; Fellow of the American Association of Obstetricians and Gynecologists. 328 Woodward Building, Birmingham, Ala.

1909.—Trout, Hugh Henry, M.D. Surgeon-in-Chief of Jefferson Hospital, Roanoke, Va. *Vice-President.* 1303 Franklin Road, Roanoke, Va.

1917.—Tupper, Paul Y., M.D. Clinical Professor of Surgery, Washington University Medical School; Visiting Surgeon St. Luke's Hospital; Consulting Surgeon, Missouri Baptist Sanitarium, Bethesda, Jewish and St. John's Hospitals, St. Louis Eye, Ear, Nose and Throat Infirmary. Wall Building, St. Louis, Mo.

1912.—Turck, Raymond C., M.D. Consolidated Building, Jacksonville, Fla.

1909.—Vaughan, George Tully, M.D., LL.D. Professor of Surgery and Head of Department of Surgery in Georgetown University; Chief Surgeon in Georgetown University Hospital; Visiting Surgeon, Tuberculosis Hospital; Consulting Surgeon, St. Elizabeth's Hospital; Consulting Surgeon, Washington Asylum Hospital; Consulting Surgeon, U. S. Public Health Service; Commander, Medical Corps, Reserve Force, U. S. Navy. 1718 I Street, Washington, D. C.

1919.—Venable, Charles Scott, M.D. Attending Surgeon Lee Surgical Hospital, San Antonio, Texas; Attending Surgeon, Robert B. Green Memorial Hospital, San Antonio, Texas. Central Trust Building, San Antonia, Texas.

1912.—Walker, George, M.D. Associate in Surgery, Johns Hopkins University. 1 E. Centre St., Baltimore, Maryland.

1911.—Waring, T. P., M.D. Savannah, Ga.

1905.—Wathen, John R., A.B., M.D. Professor of Surgery and Clinical Surgery, University of Louisville; Surgeon to St. Anthony's, and Louisville City Hospitals. 350 Francis Building, Louisville, Ky.

1907.—Watts, Stephen H., M.D. Professor of Surgery University of Virginia; Surgeon-in-Chief of the University of Virginia Hospital. University of Virginia, Charlottesville, Va.

1888.—Westmoreland, Willis F., M.D. Professor of Surgery, Atlanta College of Physicians and Surgeons. *Vice-President,* 1908. 241 Equitable Building, Atlanta, Ga.

1907.—Willis, A. Murat, M.D. Instructor in Abdominal Surgery, Medical College of Virginia; Junior Surgeon to Memorial Hospital, Richmond, Va. 405 East Grace Street, Richmond, Va.

1913.—Windell, James Tolbert, M.D. 715 West Jefferson Street, Louisville, Ky.

1905.—Winslow, Randolph, M.D., LL.D. Emeritus Professor of Surgery, University of Maryland. *President.* 1900 Mt. Royal Terrace, Baltimore, Md.

1905.—Witherspoon, T. Casey, M.D. Formerly Professor of Operative and Clinical Surgery, Medical Department, St. Louis University; Member of American Association of Anatomists. Murray Hospital, Butte, Mont.

1900.—Young, Hugh H., M.D. Clinical Professor of Urology, Johns Hopkins University, Medical Department. Johns Hopkins Hospital, Baltimore, Md.

1902.—Zinke, E. Gustav, M.D. Professor of Obstetrics and Clinical Midwifery in the Ohio-Miami Medical College, University of Cincinnati, 1896–1916; Emeritus Professor of Obstetrics, 1916; Honorary Chief of Staff and Obstetrician and Gynecologist to the German Hospital; President of the Cincinnati Obstetric Society, 1887; President, Academy of Medicine of Cincinnati, 1894; Member and Chairman of Section on Obstetrics, Gynecology and Abdominal Surgery, American Medical Association, 1914; Fellow (and Secretary) of American Association of Obstetricians and Gynecologists; Honorary Member, Jackson County Medical Society, Kansas City, Mo.; Honorary Member, Cincinnati Obstetricians and Gynecologists, 1908. 4 West Seventh Street, Cincinnati, Ohio.

GEOGRAPHICAL LIST OF FELLOWS

ALABAMA

Baker, James Norment, 602 S. Perry St., Montgomery.
Cole, Herbert Phalon, Van Antwerp Bldg., Mobile.
Du Bose, Francis Goodwin, Selma.
Heflin, Wyatt, 3216 Cliff Road, Birmingham.
Hill, Robert Somerville, Montgomery.
Hogan, Edgar P., 412–14 Empire Bldg., Birmingham.
Jackson, William R., 164 St. Michael St., Mobile.
Jordan, William Mudd, 915 Empire Bldg., Birmingham.
Ledbetter, Samuel L., Jr., 516 Empire Bldg., Birmingham.
Lupton, Frank A., 816 Woodward Bldg., Birmingham.
McAdory, Wellington P., Birmingham.
Mason, J. M., 1915 Sixteenth Ave., S., Birmingham.
Mastin, William M., Joachim and Conti Sts., Mobile.
Morris, Lewis C., 1203–7 Empire Bldg., Birmingham.
Noland, Lloyd, Employees' Hospital, Birmingham.
Rogers, Mack, 212 Twentieth St., Birmingham.
Talley, Dyer F., 1801 Seventh Ave., Birmingham.
Torrance, Gaston, 328 Woodward Bldg., Birmingham.

CALIFORNIA

Gilcreest, Edgar L., 3698 California St., San Francisco.
Sherk, Henry H., Central Building, Pasadena.

FLORIDA

Helms, John Sullivan, Tampa.
Holden, Gerry R., 513 Laura St., Jacksonville.
Rogers, Carey Pegram, 221 Laura St., Jacksonville.
Simpson, James Knox, Jacksonville.
Turck, Raymond C., Consolidated Bldg., Jacksonville.

GEORGIA

Boland, Frank K., Candler Bldg., Atlanta.
Doughty, W. H., 822 Greene St., Augusta.
Earnest, John G., 828 Candler Bldg., Atlanta.

Elkin, William Simpson, 1029 Candler Bldg., Atlanta.
Goldsmith, W. S., 262 Jackson St., Atlanta.
Hodgson, Fred. G., 746 Peachtree St., Atlanta.
Jones, Edward Groves, 714 Hurt Bldg., Atlanta.
McRae, Floyd Wilcox, Peters Bldg., Atlanta.
Nicolson, William Perrin, Healy Bldg, Atlanta.
Noble, George H., 186 S. Pryor St., Atlanta.
Rhodes, Robert L., 1103–5 Lamar Bldg., Augusta.
Waring, T. P., Savannah.
Westmoreland, Willis F., 241 Equitable Bldg., Atlanta.

ILLINOIS

Lewis, Dean, 122 S. Michigan Ave., Chicago.
Martin, Franklin H., 30 North Michigan Ave., Chicago.
Ochsner, A. J., 2106 Sedgwick Street, Chicago.
Ochsner, Edward H., 2155 Cleveland Ave., Chicago.

INDIANA

Porter, Miles F., 2326 Fairfield Ave., Fort Wayne.

KENTUCKY

Abell, Irvin, 700 Francis Bldg., Louisville.
Barrow, David, 148 Market St., Lexington.
Frank, Louis, 400 Atherton Bldg., Louisville.
Grant, Horace H., 329 Atherton Bldg., Louisville.
Hanes, Granville S., Francis Bldg., Louisville.
Hendon, George A., 646 Francis Bldg., Louisville.
Roberts, William O., Atherton Bldg., Louisville.
Sherrill, J. Garland, Masonic Bldg., Louisville.
Wathen, John R., 350 Francis Bldg., Louisville.
Windell, James T., 715 West Jefferson St., Louisville.

LOUISIANA

Allen, Carroll W., 43 Audubon Boulevard, New Orleans.
Clark, S. M. D., 1435 Harmony St., New Orleans.
Cocram, Henry S., 108 Baronne St., New Orleans.
Danna, Joseph A., Charity Hospital, New Orleans.
Gessner, Herman B., 1105 Maison Blanche Bldg., New Orleans.

Kohlman, William, 3500 Prytania St., New Orleans.
Landry, Lucian H., 2255 St. Charles Ave., New Orleans.
Maes, Urban, 1671 Octavia St., New Orleans.
Martin, E. Denegre, 3513 Prytania St., New Orleans.
Matas, Rudolph, 3523 Prytania St., New Orleans.
Miller, C. Jeff, 1638 Joseph St., New Orleans.
Parham, F. W., 1429 Seventh St., New Orleans.
Perkins, W. M., 830 Canal St., New Orleans.
Smyth, John, 724 Baronne St., New Orleans.
Souchon, Marion, Whitney Bank Bldg., New Orleans.

MAINE

Cousins, William Lewis, 231 Woodford St., Portland.

MARYLAND

Baer, William S., 4 E. Madison St., Baltimore.
Bagley, Charles, Jr., The Latrobe, Baltimore.
Bloodgood, Joseph C., 904 N. Charles St., Baltimore.
Burnam, Curtis Field, 1418 Eutaw Place, Baltimore.
Cullen, Thomas Stephen, 20 E. Eager St., Baltimore.
Davis, John Staige, The Severn, Baltimore.
Fisher, Wm. A., Jr., 715 Park Ave., Baltimore.
Finney, J. M. T., 1300 Eutaw Place, Baltimore.
Hunner, Guy LeRoy, 2305 St. Paul St., Baltimore.
Kelly, Howard Atwood, 1418 Eutaw Place, Baltimore.
McGlannan, Alexius, 115 W. Franklin St., Baltimore.
Platt, Walter Brewster, 802 Cathedral St., Baltimore.
Richardson, Edward H., 1200 N. Charles St., Baltimore.
Stone, Harvey B., 18 West Franklin St., Baltimore.
Walker, George, 1 E. Centre St., Baltimore.
Winslow, Randolph, 1900 Mount Royal Terrace, Baltimore.
Young, Hugh H., Johns Hopkins Hospital, Baltimore.

MASSACHUSETTS

Marcy, Henry Orlando, 180 Commonwealth Ave., Boston.
Mixter, Samuel Jason, 180 Marlborough St., Boston.
Richardson, Edward P., 224 Beacon St., Boston.

MICHIGAN

Cullen, Ernest K., David Whitney Bldg., Detroit.
Peterson, Reuben, Ann Arbor.

MINNESOTA

Balfour, Donald Church, Rochester.
Judd, Edward Starr, Rochester.
Law, Arthur Ayer, Syndicate Bldg., Minneapolis.
Mayo, Charles H., Rochester.
Sistrunk, W. E., Rochester.

MISSISSIPPI

Barksdale, John W., Winona.
Crawford, Walter W., Hattiesburg.
Shands, Harley R., Century Bldg., Jackson.

MISSOURI

Bailey, Fred W., 611 Metropolitan Bldg., St. Louis.
Bartlett, Willard, 410 Metropolitan Bldg., St. Louis.
Blair, Vilray Papin, Metropolitan Bldg., St. Louis.
Clopton, Malvern B., Humboldt Building, St. Louis, Mo.
Elbrecht, O. H., 423 Metropolitan Bldg., St. Louis.
Jonas, Ernst, 4495 Westminster Place, St. Louis.
Kirchner, Walter C. G., 508 N. Grand Ave., St. Louis.
Lewis, Bransford, Century Bldg., St. Louis.
Reder, Francis, University Club Bldg., St. Louis.
Seelig, Major G., University Club Bldg., St. Louis.
Tupper, Paul Y., Wall Bldg., St. Louis.

MONTANA

Witherspoon, T. Casey, Murray Hospital, Butte.

NEW JERSEY

Ill, Edward Joseph, 1002 Broad St., Newark.

NEW YORK

Boldt, Herman J., 616 Madison Ave., New York City.
Coley, William B., 6 West 50th St., New York City.
Downes, William Augustus, 424 Park Ave., New York City.
Gerster, John C. A., 18 E. 78th St., New York City.

Lloyd, Samuel, 50 E. 42d St., New York City.
Morris, Robert Tuttle, 616 Madison Ave., New York City.
Peck, Charles H., 30 W. 50th St., New York City.
Pool, Eugene H., 107 E. 60th St., New York City.
Sullivan, R. P., 270 Park Ave., New York City.

NORTH CAROLINA

Biggs, Montgomery Herman, Rutherfordton.
Fletcher, Marshall H., 199 Haywood St., Asheville.
Gibbon, Robert L., Charlotte.
Norris, Henry, Rutherfordton.
Royster, Hubert Ashley, 423 Fayetteville St., Raleigh.
Stokes, James Ernest, Salisbury.

OHIO

Bonifield, Charles Lybrand, 409 Broadway, Cincinnati.
Caldwell, C. E., The Livingston, 7th and Race Sts., Cincinnati.
Carothers, Robert, 409 Broadway, Cincinnati.
Crile, George W., 1021 Prospect Ave., Cleveland.
Freiberg, Albert H., Livingston Bldg., Cincinnati.
Hall, Rufus Bartlett, 628 Elm St., Cincinnati.
Oliver, John Chadwick, 628 Elm St., Cincinnati.
Ransohoff, Joseph, 19 W. 7th St., Cincinnati.
Reed, Charles Alfred Lee, 19 W. 7th St., Cincinnati.
Rhodes, Goodrich Barbour, The Ortiz, 4th and Sycamore St., Cincinnati.
Zinke, E. Gustav, 4 W. Seventh St., Cincinnati.

OREGON

Coffey, Robert C., Stevens Building, Portland.

PENNSYLVANIA

Clark, John G., 2017 Walnut St., Philadelphia.
Deaver, John B., 1634 Walnut St., Philadelphia.
Frazier, Charles H., 1724 Spruce St., Philadelphia.
Gibbon, John H., 1608 Spruce St., Philadelphia.
Miller, Robert Talbott, Jr., Diamond Bank Bldg., Pittsburgh.
Simpson, Frank Farrow, 7048 Jenkins Arcade Bldg., Pittsburgh.

SOUTH CAROLINA

Buist, A. Johnston, 279 Meeting Street, Charleston.
Cathcart, R. S., 75 Hasell St., Charleston.
Guerry, Le Grand, Columbia.

TENNESSEE

Barr, Richard Alexander, 800 Nineteenth Ave., S., Nashville.
Black, William T., Exchange Bldg., Memphis.
Bryan, W. A., 146 Eighth Ave., N., Nashville.
Burch, Lucius E., 210 Doctors' Bldg., Nashville.
Caldwell, Robert, 510 Jackson Bldg., Nashville.
Cowden, Charles N., Hitchcock Bldg., Nashville.
Crisler, Joseph Augustus, Exchange Bldg., Memphis.
Crook, Jere L., 110 W. Baltimore St., Jackson.
Fort, Rufus E., 303 Seventh Ave., N., Nashville.
Haggard, William David, 706 Church St., Nashville.
Malone, Battle, 624 Exchange Bldg., Memphis.
Maury, John M., Bank of Commerce Bldg., Memphis.
Newell, E. Dunbar, Chattanooga.
Smythe, Frank David, 730–33 Exchange Bldg., Memphis.

TEXAS

Beall, Frank C., 703 Lamar St., Fort Worth.
Moore, John Thomas, Kress Bldg., Houston.
Rosser, Charles M., 4002 Gaston Ave., Dallas.
Saunders, Bacon, Flatiron Bldg., Fort Worth.
Scott, Arthur Carroll, Temple.
Singleton, Albert O., American National Insurance Bldg., Galveston.
Thompson, J. E., Galveston.
Thorning, W. Burton, Kress Bldg., Houston.
Venable, Charles S., Central Trust Building, San Antonio.

VIRGINIA

Baughman, Greer, 26 N. Laurel St., Richmond.
Bell, Richard Phillips, 202 Professional Bldg., Staunton.
Bryan, Robert C., Grace Hospital, Richmond.
Coleman, Claude C., 503 Professional Bldg., Richmond.

Gwathmey, Lomax, Norfolk.
Henson, J. W., 405 N. Allen St., Richmond.
Horsley, John Shelton, 617 W. Grace St., Richmond.
La Roque, G. Paul, 603 East Grace St., Richmond.
Leigh, Southgate, 109 College Place, Norfolk.
McGuire, Stuart, 513 E. Grace St., Richmond.
McGuire, W. Edward, 411 E. Grace St., Richmond.
MacLean, Henry Stuart, 401 W. Grace St., Richmond.
Miller, Edward Howe, Jr., 6 Chestnut Place, Danville.
Payne, Robert Lee, Tazewell Bldg., Norfolk.
Peple, W. Lowndes, 1209 W. Franklin St., Richmond.
Robins, Charles Russell, 8 W. Grace St., Richmond.
Robinson, Julian McG., 753 Main St., Danville.
Ruffin, Kirkland, 218 York St., Norfolk.
Trout, Hugh Henry, 1303 Franklin Road, Roanoke.
Watts, Stephen H., Charlottesville.
Willis, A. Murat, 405 E. Grace St., Richmond.

WEST VIRGINIA

Cannaday, John Egerton, Kanowha Banking and Trust Co. Bldg., Charleston.

WASHINGTON, D. C.

Bovée, J. Wesley, The Rochambeau.
Carr, William P., 1801 K. St., N. W.
Hagner, Francis Randall, The Farragut.
Kerr, Harry Hyland, 1742 N Street, N. W.
Mitchell, James F., 1344 Nineteenth St.
Moran, John F., 2426 Pennsylvania Ave.
Shands, A. R., 901 Sixteenth Street, N. W.
Vaughan, George Tully, 1718 I St.

CONSTITUTION

ARTICLE I

The name of this Association shall be THE SOUTHERN SURGICAL ASSOCIATION.

ARTICLE II

The object of this Association shall be to further the study and practice of Surgery in its various departments, especially among the profession of the Southern States.

ARTICLE III

SECTION 1. The qualifications which must be possessed by an applicant for fellowship in the Association shall be: (*a*) Good standing in his State Association; (*b*) experience covering not less than ten years of professional work; (*c*) practice limited essentially to surgery or one of its specialties; (*d*) recommendation by three Fellows, two preferably from his own State.

SECTION 2. Application for Fellowship shall be filed with the Secretary on the blank form provided for that purpose. The Council at each annual session shall carefully consider all candidates and may nominate one for each vacancy that exists on the roll for election or rejection by the Association.

ARTICLE IV

The Honorary Fellows of the Association shall not exceed twenty-five in number. They shall be nominated by the Council and elected by the Association. They will not be required to pay any dues and shall enjoy all the privileges of other Fellows except that of voting or holding office; this exception does not apply to Founders.

ARTICLE V

SECTION 1. The officers of this Association shall be a President, two Vice-Presidents, a Secretary, a Treasurer, and a Council, elected by ballot.

SEC. 2. The President and Vice-Presidents shall be elected for one year, and the President shall not be eligible for reëlection at any time; the Secretary and Treasurer, each, for five years; and the Council as provided for in the By-laws.

ARTICLE VI

SECTION 1. It shall be the duty of the President to preside at all meetings of the Association; to give the casting vote; to see that the rules of order and decorum be properly enforced in all deliberations of the Association; to sign the approved proceedings of each meeting, and to approve such orders as may be drawn upon the Treasurer for expenditures ordered by the Association.

SEC. 2. In the absence of the President the first Vice-President shall preside, and in his absence the second Vice-President shall preside.

SEC. 3. In the absence of all three, the Association shall elect one of its Fellows to preside *pro tem.*

SEC. 4. It shall be the duty of the Secretary to keep a true and correct record of the proceedings of the meetings; to preserve all books, papers, and articles belonging to the archives of the Association; to attest all orders drawn on the Treasurer for moneys appropriated by the Association; to keep the account of the Association with its Fellows; to keep a register of the Fellows, with the dates of their admission and places of residence. He shall collect all moneys due from the Fellows and pay to the Treasurer, taking his receipt for the same. He shall report such unfinished business of previous meetings as may appear on his books requiring action, and attend to such other business as the Association may direct. He shall also supervise and conduct all the correspondence of the Association, and edit the TRANSACTIONS under the direction of the Council.

SEC. 5. It shall be the duty of the Treasurer to keep a correct record of all moneys received from the hands of the Secretary, giving his receipt for the same; pay them out by order of the Association as indorsed by the President and attested by the seal in the hands of the Secretary.

Sec. 6. It shall be the duty of the President of the Association to appoint an Auditing Committee, consisting of three Fellows of the Association, whose duty it shall be to examine the books of the Secretary and Treasurer, and report on the same on the last day of the session.

ARTICLE VII

Vacancies occurring in the offices of the Association shall be filled by appointment of the President until the next meeting. He shall also have the appointment of all committees not otherwise provided for.

ARTICLE VIII

This Constitution shall take effect immediately from the time of its adoption, and shall not be amended except by a written resolution, which shall lie over one year, and receive a vote of two-thirds of the members present.

ARTICLE IX

The Fellowship of the Association shall be limited to two hundred.

BY-LAWS

ARTICLE I

The Southern Surgical Association shall meet annually on the Tuesday of the week preceding the week in which Christmas occurs, at 10 A.M., at such place as may be designated at the preceding meeting.

ARTICLE II

The Fellows present shall constitute a quorum for business.

ARTICLE III

The annual dues of each Fellow shall be $15, paid in advance.

ARTICLE IV

The usual parliamentary rules governing deliberative bodies shall govern the business workings of this Association.

ARTICLE V

All questions before the Association shall be determined by a majority of the votes present.

ARTICLE VI

The President shall deliver an annual address at each meeting of the Association.

ARTICLE VII

The Secretary of the Association shall receive at each annual Session a draft from the President, drawn on the Treasurer, for such sum as may be voted him by the Council, for services rendered the Association, and to this shall be added the necessary expense incurred in the discharge of his official duties.

ARTICLE VIII

It shall be the duty of the Secretary, one month prior to the annual meeting, to notify the Fellows of the Association and urge their attendance.

ARTICLE IX

The authors of papers shall notify the Secretary, six weeks prior to the meeting, of the titles of their essays, so that they may be incorporated in the preliminary programme.

ARTICLE X

COUNCIL

The Council shall consist of five members; and of those elected at the primary meeting, the first shall serve five years, the second four, and the third three, the fourth two, and the fifth one year; so that subsequently one member of the Council shall be elected annually to serve five years. No member of the Council shall be eligible for reëlection. The President and Secretary shall be *ex-officio* members of the Council.

This Council shall organize by electing a Chairman and Secretary, and shall keep a record of its proceedings.

The duties of this Council shall be—

1. To investigate applications for membership and report to the Association the names of such persons as are deemed worthy.

2. To take cognizance of all questions of an ethical, judicial, or personal nature, and upon these the decision of the Council shall be final; *provided*, that appeal may be taken from such decision of the Council to the Association, under a written protest, which protest shall be sustained by the Association, and the matter shall then be referred to a special committee, with power to take final action.

3. All motions and resolutions before the Association shall be referred to the Council without debate, and it shall report by recommendation at as early an hour as possible.

ARTICLE XI

The President shall appoint at each annual meeting a Committee of Arrangements.

ARTICLE XII

The Council shall have full power to omit from the published TRANSACTIONS, in part or in whole, any paper that may be referred to it by the Association, unless specially instructed to the contrary by the Association, which will be determined by vote.

ARTICLE XIII

The Council shall have power to drop from the roll of Fellows any member who fails to pay his dues for more than one year, or misses three consecutive sessions of the Association, or who for any reason fails to retain his good standing in his State association.

ARTICLE XIV

No paper shall be read before this Association which does not deal strictly with a subject of surgical or gynecological importance.

ARTICLE XV

No paper read before this Association shall be published in any medical journal or pamphlet for circulation, as having been read before the Association, without having received the endorsement of the Council.

ARTICLE XVI

The readings of papers shall be limited to twenty minutes each, except by permission of the Association.

MINUTES OF THE PROCEEDINGS

OF THE

THIRTY-THIRD ANNUAL MEETING

OF THE

SOUTHERN SURGICAL ASSOCIATION

HELD AT THE

HOMESTEAD HOTEL

Hot Springs, Virginia

DECEMBER 14, 15 AND 16, 1920

THIRTY-THIRD ANNUAL MEETING

FIRST DAY—*Tuesday, December* 14, 1920

The following named Fellows were present:

ABELL, IRVIN.....Louisville, Ky.
ALLEN, CARROLL W.....New Orleans, La.
BAER, WILLIAM STEVENSON.....Baltimore, Md.
BAGLEY, CHARLES, JR.....Baltimore, Md.
BAILEY, FRED WARREN.....St. Louis, Mo.
BAKER, JAMES NORMENT.....Montgomery, Ala.
BARROW, DAVID.....Lexington, Ky.
BARTLETT, WILLARD.....St. Louis, Mo.
BAUGHMAN, GREER.....Richmond, Va.
BELL, RICHARD P.....Staunton, Va.
BLAIR, VILRAY PAPIN.....St. Louis, Mo.
BLOODGOOD, JOSEPH COLT.....Baltimore, Md.
BOLDT, HERMANN, J.....New York City
BONIFIELD, CHARLES LYBRAND....Cincinnati, O.
BOVÉE, J. WESLEY.....Washington, D. C.
BRYAN, ROBERT C.....Richmond, Va.
BRYAN, WILLIAM A.....Nashville, Tenn.
BURCH, LUCIUS E.....Nashville, Tenn.
CALDWELL, C. E.....Cincinnati, O.
CALDWELL, ROBERT.....Nashville, Tenn.
CANNADAY, JOHN EGERTON.....Charleston, W. Va.
CARR, WILLIAM P.....Washington, D. C.
CLARK, JOHN G.....Philadelphia, Pa.
CLOPTON, MALVERN B.....St. Louis, Mo.
COFFEY, ROBERT C.....Portland, Ore.
COLEMAN, CLAUDE C.....Richmond, Va.
COLEY, WILLIAM B.....New York, N. Y.
COUSINS, WILLIAM LEWIS.....Portland, Me.
COWDEN, CHARLES N.....Nashville, Tenn.
CRILE, GEORGE W.....Cleveland, O.

Cullen, Ernest K. . . . . Detroit, Mich.
Cullen, Thomas Stephen . . . . . Baltimore, Md.
Danna, Joseph A. . . . . New Orleans, La.
Deaver, John B. . . . . Philadelphia, Pa.
Downes, William Augustus . . . . . New York, N. Y.
DuBose, Francis Goodwin . . . . . Selma, Ala.
Finney, J. M. T. . . . . Baltimore, Md.
Frank, Louis . . . . . Louisville, Ky.
Gerster, John C. A. . . . . New York, N. Y.
Gibbon, Robert L. . . . . Charlotte, N. C.
Guerry, Le Grand . . . . . Columbia, S. C.
Haggard, William David . . . . . Nashville, Tenn.
Helms, John Sullivan . . . . . Tampa, Fla.
Hendon, George A. . . . . Louisville, Ky.
Henson, James W. . . . . Richmond, Va.
Holden, Gerry R. . . . . Jacksonville, Fla.
Horsley, John Shelton . . . . . Richmond, Va.
Hunner, Guy LeRoy . . . . . Baltimore, Md.
Ill, Edward Joseph . . . . . Newark, N. J.
Jones, Edward Groves . . . . . Atlanta, Ga.
Judd, Edward Starr . . . . . Rochester, Minn.
Kerr, Harry Hyland . . . . . Washington, D. C.
Kohlman, William . . . . . New Orleans, La.
LaRoque, G. Paul . . . . . Richmond, Va.
Leigh, Southgate . . . . . Norfolk, Va.
Lloyd, Samuel . . . . . New York, N. Y.
McAdory, Wellington P. . . . . Birmingham, Ala.
McGlannan, Alexius . . . . . Baltimore, Md.
McGuire, Stuart . . . . . Richmond, Va.
Marcy, Henry Orlando . . . . . Boston, Mass.
Martin, E. Denegre . . . . . New Orleans, La.
Martin, Franklin H. . . . . Chicago, Ill.
Mayo Charles H. . . . . Rochester, Minn.
Miller, C. Jeff . . . . . New Orleans, La.
Miller, Edward Howe, Jr. . . . . Danville, Va.
Miller, Robert Talbott, Jr. . . . . Pittsburgh, Pa.
Mitchell, James F. . . . . Washington, D. C.
Moore, John Thomas . . . . . Houston, Texas
Moran, John F. . . . . Washington, D. C.
Morris, Lewis C. . . . . Birmingham, Ala.
Morris, Robert Tuttle . . . . . New York, N. Y.
Newell, E. Dunbar . . . . . Chattanooga, Tenn.

Ochsner, A. J. . . . . Chicago, Ill.
Oliver, John Chadwick . . . . . Cincinnati, O.
Payne, Robert Lee . . . . . Norfolk, Va.
Peck, Charles H. . . . . New York, N. Y.
Pool, Eugene H. . . . . New York, N. Y.
Reder, Francis . . . . . St. Louis, Mo.
Richardson, Edward H. . . . . Baltimore, Md.
Richardson, Edward P. . . . . Boston, Mass.
Robins, Charles Russell . . . . . Richmond, Va.
Royster, Hubert Ashley . . . . . Raleigh, N. C.
Ruffin, Kirkland . . . . . Norfolk, Va.
Saunders, Bacon . . . . . Fort Worth, Texas
Simpson, James Knox . . . . . Jacksonville, Fla.
Sistrunk, W. E. . . . . Rochester, Minn.
Stokes, James Ernest . . . . . Salisbury, N. C.
Thompson, J. E. . . . . Galveston, Texas
Thorning, W. Burton . . . . . Houston, Texas
Trout, Hugh Henry . . . . . Roanoke, Va.
Venable, Charles S. . . . . San Antonio, Texas
Watts, Stephen H. . . . . Charlottesville, Va.
Willis, A. Murat . . . . . Richmond, Va.
Windell, James Tolbert . . . . . Louisville, Ky.
Winslow, Randolph . . . . . Baltimore, Md.
Witherspoon, T. Casey . . . . . Butte, Mont.

The following Honorary Fellows were present:
Long, John Wesley . . . . . Greensboro, N. C.
McMurtry, Lewis S. . . . . Louisville, Ky.

Letters and messages of regret were received from the following Fellows who were unable to attend the meeting: Charles A. L. Reed, Cincinnati, O.; John Staige Davis, Baltimore, Md.; H. H. Sherk, Pasadena, Cal.; Ernst Jonas, St. Louis, Mo.; John R. Wathen, Louisville, Ky.; R. L. Rhodes, Augusta, Ga.; R. S. Hill, Montgomery, Ala.; E. H. Ochsner, Chicago, Ill.; Lomax Gwathmey, Norfolk, Va.; Francis R. Hagner, Washington, D. C.; J. G. Earnest, Atlanta, Ga.; Frank D. Smythe, Memphis, Tenn.

On motion of the Secretary, the following visiting physicians and surgeons were extended the courtesies and privileges of the floor: Charles A. Powers, Denver, Colo.; L. S. Pilcher, Brooklyn, N. Y.; W. P. Conaway, Atlantic City, N. J.; R. D.

Foster, Toledo, O.; R. H. Jackson, Madison, Wis.; R. P. Sullivan, New York City.; J. B. Eagleson, Seattle, Wash.; J. Bentley Squier, New York, N. Y.; Carl H. Ill, Newark, N. J.; E. G. Brackett, Boston, Mass.; J. T. Van Beuren, New York, N. Y.; Major-General M. W. Ireland, U. S. Army; W. F. Shallenberger, Atlanta, Ga.; H. S. Belt, South Boston, Va.; Charles Farmer, Louisville, Ky.; W. C. Dixon, Nashville, Tenn.; J. T. Buxton, Newport News, Va.

Morning Session. The Association met in the Japanese Room of the Homestead Hotel and was called to order at 10 A.M. by the Secretary, Dr. Hubert A. Royster, Raleigh, North Carolina.

Dr. Hugh H. Trout, Roanoke, Virginia, Chairman of the Committee of Arrangements, announced the social program of the Thirty-third Annual Session, the arrangements and accommodations that had been made for the members and guests, and the Association dinner on Wednesday evening through the courtesy of the Homestead Hotel.

The Secretary then introduced Dr. Willard Bartlett, St. Louis, Missouri, President of the Association, who took charge of the meeting.

Papers were read as follows:

1. "The Semicentennial of the Introduction of Antiseptic Surgery in America," by Henry O. Marcy, Boston, Mass.

2. "Postgraduate Medical Instruction in France," by Dr. Samuel Lloyd, New York, N. Y.

3. "An Appliance for Holding Instruments while Operating," by Dr. J. W. Henson, Richmond, Virginia.

4. "Late Results of a Series of Head Injuries," by Dr. C. C. Coleman, Richmond, Virginia.

5. "Fractures of the Skull; Report of Cases," by Dr. C. E. Caldwell, Cincinnati, Ohio.

These two papers were discussed together by Drs. Robert T. Morris, Marcy, Thompson, Henson, and in closing by the authors of the papers.

6. "The Recognition of Benign and Malignant Tumors of the Breast by Exploratory Incision," by Dr. Joseph C. Bloodgood, Baltimore, Maryland.

It was moved and seconded that the discussion on Dr. Bloodgood's paper be postponed until the evening session, to be discussed in conjunction with the symposium on cancer. Carried. (Unfortunately Dr. Bloodgood was compelled to

leave on an afternoon train and, therefore, was not present during the discussion.—*Secretary.*)

NOTE.—No scientific session was held in the afternoon, the time being devoted to golf, riding, swimming, etc.

Evening Session.—The Association reconvened at 8 P.M., and was called to order by the President.

7. "The Control of Cancer," by Dr. Charles A. Powers, Denver, Colorado, President of the American Society for the Control of Cancer (by invitation).

8. "Cancer Infection," by Dr. A. J. Ochsner, Chicago, Ill.

9. "Cancer of the Uterus," by Dr. John B. Deaver, Philadelphia, Pennsylvania.

10. "Radium in Carcinoma of the Uterus," by Dr. William Kohlman, New Orleans, Louisiana.

11. "Electric Conductivity Observations on Malignant and Benign Tumors, with a Further Note on Operations for Cancer of the Large Intestine," by Dr. George W. Crile, Cleveland, O.

12. "Carcinoma of the Kidney," by Dr. Alexius McGlannan, Baltimore, Maryland.

13. "Life Expectancy Following Radical Amputation for Cancer of the Breast," by Dr. W. E. Sistrunk, Rochester, Minn.

The symposium on cancer in conjunction with Dr. Bloodgood's paper was discussed by Drs. MacCarty, Marcy, Horsley, Mayo, Clark, Coffey, Cullen, Jones and Coley, after which the discussion was closed by Drs. Ochsner, Deaver and Sistrunk.

On motion, the Association adjourned until Wednesday, at 9 A.M.

SECOND DAY—*Wednesday, December* 15, 1920

Morning Session. The Association met at 9 A.M., and was called to order by the President.

14. "Local Anesthesia in Kidney Surgery in Bad Risks," by Dr. Carroll W. Allen, New Orleans, Louisiana.

15. "An Analytical Study of Fifty Cases of Ureteral Stricture and Pyelitis," by Dr. James N. Baker, Montgomery, Ala.

These two papers were discussed together by Drs. Hunner, Mayo, Cullen and Shallenberger (by invitation), after which the discussion was closed by the essayists.

16. "Delayed Implanting of Pedicle Flaps of Doubtful Circulation," by Dr. V. P. Blair, St. Louis, Missouri, which was discussed by Drs. Horsley, Ochsner, Thompson, Mayo, Cald-

well, Allen, Martin, Carr, Finney, Bartlett, and in closing by the essayist.

The President appointed as a committee to audit the accounts of the Secretary and Treasurer, Drs. L. E. Burch, F. Reder and R. L. Payne.

17. "Further Experience in Operating for Bony Ankylosis of the Jaw," by Dr. W. P. Carr, Washington, D. C.

Discussed by Drs. Baer, Blair, and in closing by the essayist.

18. "Acute Intestinal Obstruction Due to Strangulation of a Loop of Small Intestine by Meckel's Diverticulum; Operation Within Twelve Hours; Recovery," by Dr. William B. Coley, New York, N. Y.

Discussed by Drs. Watts, McGlannan, Coffey, Winslow, Marcy, Long, Hendon, Bryan, Cullen, and in closing by the essayist.

19. "Voice Changes in Disease of the Thyroid Before and After Operation," by Dr. E. S. Judd, Rochester, Minnesota.

Discussed by Drs. Crile, Ochsner, Jones, and in closing by the essayist.

On motion the Association adjourned until 2 P.M.

Afternoon Session. The Association reconvened at 2 P.M., and was called to order by Dr. C. Jeff Miller, New Orleans, Louisiana, Vice-President, who announced that the first order would be the delivery of the President's Address.

President Bartlett then delivered an address entitled "An Estimate of the Value of Local Anesthesia in the Surgery of Today."

20. "Gastric and Duodenal Ulcers," by Dr. Charles H. Mayo, Rochester, Minnesota.

21. "Ulcer of the Jejunum following Gastro-enterostomy," by Dr. J. Shelton Horsley, Richmond, Virginia.

22. "The Surgical Treatment of Pylorospasm," by Dr. J. M. T. Finney, Baltimore, Maryland.

These three papers were discussed together by Drs. Coffey, Deaver, Watts, Ochsner, Carr, Crile, and in closing by the authors of the papers.

23. "Appendicitis and the Rubber Glove," by Dr. Robert T. Morris, New York City.

24. "Clinical and Experimental Observations in the Use of Saline Irrigations in the Treatment of Diffuse Peritonitis," by Dr. A. Murat Willis, Richmond, Virginia.

25. "Gall-bladder Surgery," by Dr. T. Casey Witherspoon, Butte, Montana.

26. "Total Extirpation of the Left Lobe of the Liver for Cavernous Angioma," by Dr. C. H. Peck, New York, N. Y.

These four papers were discussed together by Drs. Marcy, Cullen, Mayo, Thompson and Gerster.

On motion, the Association adjourned until Thursday, 9 A.M.

THIRD DAY.—*Thursday, December* 16, 1920.

Morning Session. The Association met at 9 A.M. and was called to order by the Vice-President, Dr. Miller.

27. "Relaxation of the Vaginal Outlet; Is the Obstetrician Responsible," by Dr. L. E. Burch, Nashville, Tennessee.

28. "The Action of the Forces of Mechanism of Labor" (motion pictures), by Dr. John F. Moran, Washington, D. C.

29. "Retroflexion of the Uterus," by Dr. John G. Clark, Philadelphia, Pennsylvania.

30. "Uterine Prolapse; Permanent Fixation by Means of Fascial Flaps," by Dr. W. Burton Thorning, Houston, Texas.

These four papers were discussed together by Drs. Coffey, DuBose, Richardson, Bartlett, Hunner, Reder and Bonifield, after which the discussion was closed by Dr. Clark.

31. "Surgical Treatment of Acute Pelvic Infections in Women," by Dr. F. G. DuBose, Selma, Alabama.

32. "Report of a Case of Large Ovarian Cyst in a Child Seven Months of Age," by Dr. W. A. Downes, New York, N. Y.

These two papers were discussed by Drs. Winslow, Martin, Bryan, and in closing by Dr. Downes.

33. "Kraurosis Vulvæ and Inguinal Adenitis of a Malignant Nature," by Dr. Francis Reder, St. Louis, Missouri.

Discussed by Dr. Bonifield and in closing by the essayist.

The President: The time has come to interrupt the scientific program for the transaction of business, and the first order is the report of the Auditing Committee.

Dr. L. E. Burch: Your Auditing Committee begs to report that they have carefully examined the books and accounts of the Secretary and Treasurer for the past year and find them correct with the exception of one minor clerical error in the Treasurer's account.

It was moved and seconded that the report be adopted. Carried.

The President: The next order is the report of the Council by the Secretary.

The Secretary presented the following report:

At the regular meeting of the Council, held in this hotel (the Homestead) Wednesday afternoon December 15, the following recommendations were made to the Association:

1. The names suggested for the Board of Governors of the American College of Surgeons are Dr. LeGrand Guerry, Columbia, South Carolina; Dr. C. C. Coleman, Richmond, Virginia; and Dr. E. D. Martin, New Orleans, Louisiana.

2. The Secretary was instructed to remind the Fellows that at the next meeting of the Association the three-year-attendance rule would be strictly enforced. At the Baltimore session it was agreed that as so many of the Fellows were in the service of the government, this rule would be abrogated until the 1921 session. The Secretary respectfully calls attention to the resumption of the action of this rule.

3. The Secretary was asked to transmit messages of good will to Dr. Joseph Ransohoff, Cincinnati, Ohio, who is ill at his home and unable to attend; also for the same reason to Dr. I. S. Stone, Washington, D. C., Dr. John D. S. Davis, Birmingham, Alabama, and Dr. F. W. McRae, Atlanta, Ga.

4. The resignations of Drs. E. A. Balloch, Washington, D. C., Fred T. Murphy, Detroit, Michigan, Albert Vander Veer, Albany, N. Y., and W. W. Russell, Baltimore, Maryland, were accepted.

5. The deaths of the following Fellows have been reported and the Secretary asked to record them properly in the Transactions: Drs. L. C. Bosher, Richmond, Virginia; M. C. McGannon, Nashville, Tennessee; I. L. Watkins, Montgomery, Alabama; and Frank Martin, Baltimore, Maryland.

6. The death of our honorary Fellow, Dr. J. A. Goggans, Alexander City, Alabama, a Founder of the Association, is likewise to be recorded.

7. Dr. Albert Vander Veer was nominated for honorary fellowship.

8. The following names were suggested to fill vacancies in the roster of Fellows: W. Lowndes Peple, Richmond, Va.; Frank C. Beall, Fort Worth, Texas; Lloyd Noland, Birmingham, Ala.; John H. Gibbon, Philadelphia, Pa.; William Alexander Fisher, Jr., Baltimore, Md.; Jere L. Crook, Jackson,

Tenn.; Raymond P. Sullivan, New York, N. Y.; Albert O. Singleton, Galveston, Texas; Frank K. Boland, Atlanta, Ga.

9. The following nominations of officers are recommended: President, Dr. Randolph Winslow, Baltimore, Maryland; Vice-Presidents, Dr. Hugh H. Trout, Roanoke, Virginia, and Dr. James N. Baker, Montgomery, Alabama. As a member of the Council to fill the vacancy caused by the retirement of Dr. Bacon Saunders, the Council suggests the name of Dr. Willard Bartlett, St. Louis, Missouri. The Council respectfully recommends that Pinehurst, North Carolina, be chosen for the next place of meeting. At this meeting Dr. R. L. Gibbon, Charlotte, North Carolina, will be requested to act as the Chairman of the Committee of Arrangements.

Respectfully submitted,

THOMAS S. CULLEN
BACON SAUNDERS
WILLIAM D. HAGGARD [Council]
JAMES E. THOMPSON
STUART MCGUIRE, *pro tem.*

The President: The report of the Council is before you for action.

Dr. J. Wesley Bovée: I move that the report of the Council be accepted as presented.

Seconded and carried.

President Bartlett appointed Drs. Saunders and Bovée to escort the newly elected President to the platform.

Dr. Winslow was received with great applause, and in accepting the presidency, said: Mr. President and Fellows of the Southern Surgical Association: When it was intimated to me very delicately that there was a possibility that I might be the succeeding president of this Association, it was a great surprise. When I was told that I was the President of this Association I was overwhelmed with the responsibility of the position, and with my inability to fill it in a satisfactory manner.

To be a member of an association of this kind, and notably to be a Fellow of the Southern Surgical Association is a great honor. To be elected to preside over the destinies of this Association for a year is a wonderful distinction. I am fully aware, ladies and gentlemen, of my inability to properly fill the office which has been so ably presided over by my predecessors, and I would that I were an orator at this time. I was born in

North Carolina, and consequently am entitled to be President of the Southern Surgical Association from the location of my birth. Every man in North Carolina, with the exception of myself, is a natural born orator. (Laughter.) My friend John Wesley Long is a notable example of a person who was born an orator. Unfortunately I left North Carolina when I was a young boy, and my ability as an orator is very small. Indeed, years ago, when I was demonstrator of anatomy, there was an erratic and rather old Englishman who was a student at the University of Maryland. He said that when he wanted to study anatomy he went to Winslow; that when he wanted to study bones he went to Winslow, and when he got through with the bones he was through with Winslow. There was no sentiment in that, and I am afraid that there is no sentiment in me. However, I assure you that I have sentiments of the highest gratitude and consideration for the exalted position to which you have elected me. That which I lack in adaptability to the office, I shall attempt to make up in assiduity of attention. Gentlemen, I assure you, that I not only appreciate your generous action, but that I shall do my best to merit it. (Loud applause.)

34. "(*a*) Tuberculous Ulcer of the Anterior Vaginal Wall with Resection of Ulcer; (*b*) Diverticulum of the Duodenum," by E. K. Cullen, Detroit, Michigan.

Discussed by Dr. E. H. Richardson.

Dr. William L. Cousins, Portland, Maine: Not having been born in North Carolina, I am afraid I cannot keep up the reputation of Dr. Long and our President. At this time, however, I think it is fitting for us to express our appreciation to those in charge for the able and splendid manner in which this meeting has been conducted by our President, our Secretary and our local Committee. The dinner last evening was all that one could desire. The music was splendid. The impersonations which Mrs. Cocke rendered gave us a glimpse into the daily life of the southern negro and also a glimpse into the past history of the sufferings of those who actually observed them. Thanks are due to Dr. Payne, our able golf manager, for carrying out such a splendid tournament. We are grateful for the splendid coöperation of the management of this hotel in making our visit here so pleasant and agreeable. Our gratitude should also be extended to

the manager's assistants and even to the bell boys who answered so willingly our calls for ice-water. Their duties were not as arduous as they would have been, had the eighteenth amendment not been adopted, yet they showed their willingness to serve us at all times. I move, Mr. President, that these resolutions be adopted.

Seconded and carried unanimously.

On motion, the Association adjourned until 2 P.M.

Afternoon Session. The Association reconvened at 2 P.M., and was called to order by the President.

35. "Two Unusual Subphrenic Conditions," by Dr. Randolph Winslow, Baltimore, Maryland.

Discussed by Drs. Finney, Bailey, and in closing by the essayist.

36. "Fundamentals of the Ptosis Question," by Dr. R. C. Coffey, Portland, Oregon.

Discussed by Drs. Bonifield and Thompson.

37. "Hip-joint Disarticulation with Ligation of the Common Iliac Artery," by Dr. Fred W. Bailey, St. Louis, Missouri.

38. "Ligation of the External Iliac Artery and Vein Above and Below a Communicating Bullet Wound of These Two Vessels," by Dr. G. Paul LaRoque, Richmond, Virginia.

These two papers were discussed by Drs. Caldwell, Watts, Martin, Royster, McGlannan, and in closing by the essayists.

The program having been completed, the Secretary, on behalf of the retiring President and himself, thanked the members for their courtesy and for their ready response both before and during the meeting to the wishes of the officers. He expressed the hope that the Fellows would turn out in full force at the meeting to be held at Pinehurst, North Carolina, in December, 1921.

Dr. Fred W. Bailey, St. Louis, Missouri, moved that a vote of thanks be extended to the officers for the able and impartial manner in which they had conducted the deliberations of the Association.

Seconded and carried.

As there was no further business to come before the meeting, on motion, the Association adjourned to meet at Pinehurst, North Carolina, December 13, 14, 15, 1921.

HUBERT A. ROYSTER, M.D.,
Secretary.

ADDRESS OF THE PRESIDENT.

AN ESTIMATE OF THE VALUE OF LOCAL ANESTHESIA IN THE SURGERY OF TODAY

By Willard Bartlett, M.D.
St. Louis, Mo.

Our Association exerts a widespread influence in molding medical opinion, hence this appeal for you to champion a cause to which several of our Fellows have made notable contributions. This matter forces itself upon our attention, since a survey of the busy clinics indicates that a few authorities go to one extreme or the other in the matter of local anesthesia, that some unite on the rational viewpoint of it having a certain definite field of usefulness, while many consider it not at all.

We shall concern ourselves today largely with a recital of the impressions which have been gained by many years' observation of a large number of patients before, during and after the employment of local anesthesia of one sort or another, confining the discussion to methods that are highly practical, thoroughly safe, fairly easily acquired and in routine daily use in my own clinic. This should, then, resolve itself into an intimate consideration of how and why we use local anesthesia together with a summary of our results. I may state that it has been written in part by the patients themselves, dealing, as it does, with their impressions which indeed, are often expressed in their own words.

No more than passing reference will be made to the age-old use of cold, pressure, constriction and other procedures for the production of local anesthesia. They were rendered obsolete when two discoveries of the first magnitude made the infiltration technic of Reclus possible, viz.: invention of the hypodermic syringe by Wood, in 1853, and injection by von Anrep, in 1879, of cocain under the skin of his arm, followed by the development of an anesthetic area.

"To the student of American surgical history it will be a source of pleasure to recall the fact that probably the first clinical demonstration of the value of cocain, when used by the subcutaneous method for purposes of surgical anesthesia, was made by American investigators. Beginning with the earlier experiences of Hepburn (November 15, 1884), of Hall and Halsted (December 6, 1884), and of J. Leonard Corning (1885–86), it is gratifying to note that the essential and fundamental principles upon which rests the most effective technic in cocain anesthesia had been foreshadowed, and in some particulars completely elaborated by these early pioneer efforts of American surgeons." (Rudolph Matas, M.D., Local and Regional Anesthesia with Cocain and Other Analgesic Drugs—the Latest Methods. Report of the Chairman of the Section of Surgery of the Louisiana State Medical Society, contributed to the Proceedings of the Meeting held in New Orleans, April 19, 20 and 21, 1900.)

In order that credit may be given where it is due, I take the liberty of quoting *verbatim* from a personal communication received from Dr. Matas: "Dr. Halsted's work began almost immediately after Koller had made his epochal announcement of the anesthetic practice of cocain on the eye, at the Heidelberg Ophthalmologic Congress in September, 1884. He set to work at once at the Roosevelt Hospital, and before December, 1884, had discovered at least three, if not four, fundamental facts, which he demonstrated experimentally and clinically, in which he antedated *all* other investigators.

"The discoveries are: (1) The *intradermal* as distinguished from the subcutaneous method of infiltration; (2) the value of water as a local anesthetic and of the *efficiency of very dilute analgesic solutions*, in which he antedated Schleich by at least four years; (3) the *neuroregional method*, or regional anesthesia by nerve blocking, which he clearly demonstrated by blocking the inferior dental at the spine of Spix, and thus obtaining a complete anesthesia of the teeth of the lower jaw, which permitted the painless extraction of the teeth. See Hall's letter in the *New York Medical Journal*, December 6, 1884, and Raymond's report, *New York Odontological* Society, 1885, who describe a painless operation on the teeth, in December, 1884, after Halsted had injected the inferior dental at its entrance into the inferior dental canal. On all these points there can be no question of his right to priority, and I also believe that he was the first to note; (4) the prolongation of the anesthetic action of the drug by circular constriction and retardation of the circulation in the infiltrated area."

Braun writes in the third edition of his well-known book on local anesthesia that further work along this line was done in 1885 by Corning, who injected 2 to 3 per cent cocain solution between the lower dorsal spinous processes of a man and of a dog, with the result that anesthesia of the lower extremities quickly supervened.

One needs no more than mention that there are six methods of employing the local anesthetic agents of today, viz.: (1) Direct infiltration of the field; (2) circular infiltration about the field; (3) nerve-blocking, in which the agent is injected directly around or into an isolated nerve; (4) intravenous injection; (5) arterial injection, and (6) surface application. For the purposes of general surgery we may well confine our attention to the first three procedures, since the intravenous method has a narrow field, the arterial is attended by obvious disadvantages and surface anesthesia is used only in the limited surgical specialties.

Psychologic Considerations. I am indebted to Professor Swift, of Washington University, for his assistance in interpreting some of the interesting psychological aspects of the local anesthesia problem. One who studies the subject from this point of view early notes that there is in different patients a marked individual difference in receptivity to pain stimuli, which is largely influenced by race, nationality, sex, age, intelligence, character, training, state of health, fatigue and surrounding influences. Nor is it pain alone which we have to control; our problem is, at the same time, to combat the anticipation of pain and the age-old fear of pain. Our problem should then be undertaken before the sufferer enters the operating room proper, and has to do not only with the patient but with the patient's point of view. We might even go farther back than this and safely make the statement that public appreciation of local anesthesia is secondary in importance only to the intrinsic value of the procedure itself. Only in this way, then, can it come about that many an individual may be influenced to have a needed operation done after being long held back by the dread of a general anesthesia. This is, I think, particularly true of patients who come to the surgeon for the second time after once having had a general narcosis, a fact which is especially impressed upon one by the individual whose first convalescence has been unsatisfactory to him. I have in mind now a gentleman whose sigmoid we resected for cancer, under ether; he experienced pneumonia, empyema, thrombophlebitis and a postoperative hernia in consequence. It was many months before this patient returned to his accustomed health, and then, as may be easily imagined, he never considered a repair of his incisional hernia until told that this could be readily accomplished without a general anesthesia.

A wonderfully steadying effect is exerted upon a prospective local anesthesia patient by allowing him to talk with one who has experienced this form of treatment. In most instances this does more than anything else known to me

to inspire confidence in the method. An expression of the same idea impressed me recently when a father desired his son to witness the performance of a double herniotomy under infiltration, his reason for this unusual request being that the younger man also needed a herniotomy but had withheld consent because he was afraid of an anesthetic. I am inclined to think that the greatest good to the greatest number might be accomplished under such circumstances by relaxing the ordinary operating room rules in as far as they apply to visitors.

A patient who has gone through one operation under local anesthesia is, in my experience, more amenable to a second undertaking of the same character than is the individual who has once been under ether. I recall to memory just now a prominent attorney who had taken ether years before I saw him. Then I repaired a right-sided inguinal hernia for him under infiltration. About one year later, after indulging in athletics of unusual violence, he returned to me with a hernia on the left side. He made light of the prospect of a third operation, because, as he said, he did not have to take ether; surely he should have been in a position to judge, because he had had experience with both the general and the local methods.

In their opposition to a general anesthesia many patients reason that a drug which renders them unconscious is a highly potent agent which might conceivably interfere with the truly vital functions, and surely one cannot be blamed for considering seriously any such profound alteration in the course of his ordinary existence. It does not require much of a psychologist to reason that one who enters a state of somnolence so deep that pain cannot affect him may conceivably never awaken again; however, it remains for the surgeon to balance the relative risks of the two procedures against one another, but an ideal solution of the problem may be said to exist when the viewpoint of the patient coincides with that of his medical adviser.

The psychological tendencies of people differ in the matter of remaining awake on the operating table. One may say: "I do not want to know anything about the procedure. I know I shall not be hurt, but I cannot bear the thought of being awake in an operating room and of being cut." On the other hand, another may say: "I do not wish to lose consciousness for a single moment. I want to know what is going on, even at the expense of some pain." The surgeon, who is a student of psychology, humors the natural tendencies of either type of patient; in fact, it is a very good plan in many instances not to bring up a discussion of an anesthesia until the operating room has been reached unless the patient has demanded a consideration of this matter beforehand. A reasonable individual has so much confidence in the surgeon selected that he is likely to coöperate in whatever is suggested. Hence there is no special reason for burdening him with details, which he often cannot clearly comprehend and which may merely cause him uncertainty and worry. Again, it sometimes does very little good to map out a definite and inelastic plan, since one cannot foretell how even a willing patient will react under local anesthesia until the operation has commenced. Here, as elsewhere in medicine, every patient is to some extent a law unto himself and demands individual treatment.

A Consideration of the Drugs Employed. Paul Erlich, named the drugs which produced local anesthesia "Anesthesiphores," according to the grouping of their atoms. The atomic grouping of cocain was first determined, then it was reproduced synthetically and the newer local agents, such as novocain, were the result of further study along the same line. It is pretty generally admitted that such an agent to be acceptable must fulfill certain necessary requirements. It is to be soluble in water; it is to stand boiling; it is to combine with adrenalin; it cannot be more than mildly toxic, cannot be irritating during injection, nor must it produce permanent injury to the tissues.

All the chemicals in this group work in very much the same way; but some of them are highly irritating for the moment, others produce a transient effect, some (like cocain) are highly toxic and others exert considerable tissue damage. Local agents act as anesthetics because they are soluble in the lipoids of the peripheral nerves, and most experimenters consider their action to be physical rather than along chemical lines. These agents have a special affinity for sensory nerves, affecting them earlier and much more profoundly, and for a longer time than they do the motor variety. This selective action may quite well be due to the fact that in mixed nerves, at least, the sensory fibers are said to run on the outside of the nerve bundles.

All of these local agents, in addition to being protoplasm poisons, are at the same time toxic in the general sense by their effect on medullary centers; they are dangerous in proportion to the dose used and to the rapidity of absorption. Their general toxicity is inhibited on the other hand by many thing which slow absorption, viz.: cold, constriction or the admixture of adrenalin. The respiratory center in the medulla is the first to suffer and the one most deeply affected, hence prolonged artificial respiration may in some instances be the means of saving life.

Exhaustive experiments have shown that novocain, now produced in this country under the name of procain, better than any other drug fulfills all the requirements mentioned. It is only one-tenth to one-fifth as toxic as cocain, according to the animals on which we experiment. It is non-irritating and produces absolutely no tissue damage. It can, however, be used in quantities large enough to cause death, as we have frequently demonstrated on animals, respiration ceasing long before the heart stops beating. Six ounces of ½ per cent. solution of novocain poured into the peritoneal cavity of a fifteen-pound dog caused death from respiratory failure in about twenty minutes. Naturally enough a drug which conceivably produces death may surely be said to exert a

general effect when used as a local anesthetic. I think this is frequently observed in our surgical clinics when comparatively large amounts of the drug are used. We have, however, used eight, ten, twelve and in a few instances sixteen ounces (500 to 1000 c.c.) of ½ per cent. infiltration solution without observing serious toxic consequences. Of course a very large amount, if used at all, must be injected over a considerable period of time and absorption delayed by adrenalin.

I may state in passing that very little difference has been observed in our clinic between the effects of ½ and ¼ per cent. novocain in infiltration, although this runs counter to the experiments of most operators. I find, too, that the effect of novocain in ½ per cent. solution lasts no longer than two to four minutes unless adrenalin has been added; however, others, whose opinions I value, differ with me on this point. The use of adrenalin, on the other hand, greatly lengthens the effect of a ½ per cent. infiltration. In one instance I infiltrated the anterior planes of the neck for a thyroidectomy; then was delayed by a surgical emergency from beginning the operation, and when finally the skin suture was finished, two hours and twenty minutes after the injection of the neck, the anesthesia was still practically perfect. It is hardly fair to dismiss this phase of the subject without mentioning at least that tissue changes, which have been blamed upon local agents, have to my definite knowledge been due to the fact that isotonic solutions were not used. It goes without saying, then, that novocain or any similar agent is to be dissolved in physiological salt solution rather than in sterile water.

Effect on Different Tissues. All who have investigated the response of the different tissues to pain stimuli agree pretty well that the skin is much more sensitive than are the other structures of the body. This is particularly true of the finger tips, and least so of the skin of the back, other areas approaching one or the other extreme in about the

proportion that they are commonly exposed to pain stimuli. Muscle sheaths are highly sensitive and must be treated accordingly. Muscle and fat, on the other hand, are much less so and may be handled with a certain degree of impunity unless a vein or a nerve be encountered. Periosteum is acutely sensitive on areas which lie superficially beneath the skin, but less so in other parts of the body. The nerve supply of bone comes from the periosteum, hence bone sensation is largely dependent upon the treatment of the periosteum; indeed, bone is said to be practically anesthetic if the periosteum has been removed. Inflammatory affections of all tissues make them just as acutely sensitive to the injection of local agents as they are to all other forms of stimulation. Edema, on the other hand, is generally thought to decrease tissue sensibility.

The Advantages of Local Anesthesia. It is difficult to summarize in a logical manner the advantages of this method, since the needs of each patient are so highly individual; but one may sketch them in a general way. Not the least of them is the coöperation of the patient which we must secure at every stage of a procedure under properly conducted local anesthesia. This is especially valuable in demonstrating the voice during thyroidectomy, in finding the sac of a hernia or in coapting the edges of an abdominal incision which would be hard to close under ordinary circumstances. One may be practically sure, if his technic be correct, that he creates no immediate danger to life and thus escapes the possibility of a death on the table, the most shocking circumstance possible in connection with a surgical operation, and more likely than any other to deter patients from entering the operating room. We greatly lessen the danger of operative shock; since, when we operate under any form of local anesthesia, we do so with all centripetal stimuli cut off from the cerebral centers—something which is, as Crile has so well shown, not true under general anesthesia alone. A refining influence is also exerted upon the operator's technic, since

crude, rough work cannot be done without a general anesthetic. We also greatly reduce the mortality of surgery by decreasing the likelihood of postoperative complications which may prove fatal, such as pneumonia, organic parenchymatous degenerations, etc.

No necessary detail of a multiple operation has to be omitted, since there is not the risk which attends a prolonged ether anesthesia; having in mind, of course, a due regard for the patient's state of fatigue, which can be minimized by the use of morphin, during a lengthy procedure. There are none of the immediate complications which so frequently are noted just after the patient regains consciousness, such as restlessness, sweating, mucus in the bronchial tree, nausea, sore jaw or tongue and conjunctivitis, the last three due to manual carelessness of an anesthetist. Then, we do not see the same amount of postoperative pain after local as after general anesthesias, due no doubt to the patient's undiminished ability to endure it. However, I must not dwell too strongly upon this comparison, since there is some reaction after a cutting operation, no matter what form of anesthesia may be used.

Some may urge, in criticism of the method, that it requires special training, that a surgeon must be particularly skilful and gentle to use it and that all local anesthesias are not quite equally successful, that it is somewhat time-consuming and that it is not equally adapted to all procedures. These are all criticisms which reflect lack of experience or of refinement on the part of the one making them, and I believe they are heard less frequently as knowledge of the subject becomes more and more widespread.

Indications for Local Anesthesia. The indication for local anesthesia is far from universal. It depends first of all upon the ability and inclination of the surgeon, to say nothing of the condition and attitude of the patient, as well as his age, race, training and intelligence, all of which must be taken into consideration. Local anesthesia may be reason-

ably considered indicated in obstructive conditions of the air passages, inflammatory respiratory trouble, circulatory decompensation, acute abdominal emergencies, renal insufficiency, toxic conditions (goiter, etc.), chronic alcoholism, marked obesity and in very old age. The same is true if a general anesthesia has been used in the very recent past and if the patient must for any reason become ambulatory immediately after the operation. Many consider local infiltration anesthesia especially indicated in fractures and dislocations, arguing that a patient who is awake can coöperate with a surgeon in applying splints and preserving the contour of plaster until it is dry. In a simple fracture the tissue bag thus created is filled with ½ per cent. novocain and the muscles are completely relaxed in consequence, while it is claimed for a dislocation that the rent in a capsule full of fluid is much more easily found than that in one that is empty, as ordinarily seen.

Contra-indications. There are a few definite contra-indications, in my opinion, to the use of local anesthesia. Perhaps with increasing experience and more study of the subject, some or all of them may be modified or removed. However, at the present time, I do not believe that any form of local anesthesia is advantageous with patients at an age when they cannot coöperate with the surgeon; still, I am perfectly aware that some men, experienced in this line, following Farrs' example, operate on very young children with satisfaction.

I believe local anesthesia to be contra-indicated in a case where the patient has an unreasoning fear of it, or in one who manifests unwavering opposition to it, or in one whose nervous system is not under fair control. It may be used in these classes of patients with good results, however, if it is masked by gas or by a very light ether anesthesia. This is really a phase of the subject which cannot be taken too seriously, since a lack of coöperation from a refractory patient has prevented us more than once from getting the local agent

into the desired region, with a correspondingly imperfect anesthesia as a result.

In May, 1920, a young man applied to me for a herniotomy under local anesthesia, but after he had fainted during a physical examination, which was not in the least exacting, he of his own accord very wisely suggested the substitution of ether. This was done, and I think would have been done by almost any surgeon who considers the patient's psychological aspect; still, I cannot dismiss this phase of the subject without mentioning that a large dose of morphin given just previous to the injection, frequently, without inducing toxic symptoms, takes away the patient's interest in the procedure, and thereby negatives his being temperamentally unsuited to local anesthesia. It is also a question in my mind whether one should ever depend upon it alone for the performance of an operation which goes far beyond the ordinary time limits.

Morphin. The margin of safety of morphin and similar drugs is so small that they are never indicated for their general anesthetic effect. The patient possessing a stable nervous equilibrium does not actually need any sedative if the local anesthesia be perfectly conducted; however, the delicately balanced individual will gain much comfort from it. The operator must always bear in mind, however, its marked tendency to cause vomiting at most unlooked-for and unwished-for moments.

We have, in many instances, introduced morphin with the infiltration solution, since during the subsequent operation it exerts its influence at the time it is most needed if employed in this way. Probably, too, its toxic influence is lessened because it is more slowly absorbed when used in combination with adrenalin, just as has been shown to be true of novocain itself.

The dosage of morphin varies greatly with the age and condition of the patient. One-half to one grain is tolerated without undue symptoms by a gall-bladder patient who has had the drug used in many of her attacks. On the other hand

a very small dose may be more than a young child can tolerate without damage. An extreme tolerance is exhibited by patients afflicted with exophthalmic goiter, due I am sure to their rapid oxidation of it. I have used as high as 2 grains at a dose in one such sufferer who did not even go to sleep nor vomit, although a relatively small dose, *i. e.*, 1 grain, had acted as an irritant on a previous occasion and caused nausea and vomiting. It requires considerable temerity to mention such doses, and I surely do not wish to be placed in the position of advising them as a routine; still, it goes to show that the subject of morphin dosage offers food for thought. It may be well to remark here that morphin should never be used with local anesthesia on an ambulatory patient, since it is likely to have a much more temporary debilitating influence than is the local anesthesia or the minor operation itself.

When, during the progress of an operation, symptoms of approaching morphin intoxication present themselves, as has occasionally happened, we are in the habit of allowing the patient to drink one or more cups of strong, black coffee on the operating table. I am inclined to think that this may have prevented an embarrassing situation in more than one instance.

The Technic In General. There is a great deal more to the technic of local anesthesia than the mere knowledge of how, when and where to inject. The general care of the patient's psychological side in the operating room is scarcely second in importance to the local manipulation. It will occur to any one thinking along this line that none of us possess the maximum of courage and patience when enduring the pangs of hunger; hence it long ago became routine in our clinic to give the patient his breakfast as usual on the day of operation, providing, of course that no general anesthesia is to be used.

Mental control should always be attempted by trying to secure the patient's attention and then engaging him in a

discussion of one of his leading interests. These are not usually difficult to ascertain, and in this way the sympathy of the individual is enlisted, also his coöperation often gained. The person who is inclined to balk at the injection may often be rendered amenable to suggestion by the presence of a sympathetic anesthetist, also by the sight of a gas or ether apparatus which he is assured is at his command. It is surprising to note how often this little ruse will work; very rarely, however, will the patient take advantage of the opportunity of getting a general anesthetic, provided the local has been well managed. This line of reasoning has been carried a bit further in certain instances by allowing the patient, after novocain has been injected, to get the faint odor of ether throughout the operation. The satisfied individual will often not differentiate sharply between the odor of ether and an ether anesthesia, providing, of course, that morphin has been used and the infiltration been adequately made.

Local anesthesia patients are not to be used as clinic material. Their status can be rendered satisfactory only in a room which is quiet and can on occasion be isolated. There are sensitive individuals who should be blindfolded and have the ears plugged before anything is done, thus guarding the special senses against insult. With each of the sensory nerves guarded against pain stimuli and the mental apparatus protected by morphin the injection may be made anywhere successfully, with the patient interested in music, conversation, the telephone or reading a book. We often do it in the operating room if no spectators are present, but our more sensitive patients have this done in bed and are not transported up stairs until they have regained a wanted composure. One should, as a matter of course, never take a patient to the operating room for a form of injection, such as nerve-blocking, which necessitates a long wait between the injection and the operation.

I have no doubt that we shall, for making these injections,

some day have special rooms, decorated appropriately and lending every facility for attracting the sufferer's attention as desired. One who has not done this work may be surprised to know that nothing proves more diverting during infiltration or operation than a few puffs on a cigar or cigarette, a distinct solace to any man who is addicted to the use of nicotine. By the same rule a drinker must have his normal dose of alcohol before going to the operating room, and I have frequently given him more during the progress of the infiltration or subsequent operation, with excellent effect. Alcohol will for any of us relieve the tedium of any long-seeming experience, such as the stay in an operating room proves to be. The electric fan is one of our valued aids when sympathetic control begins to let go during a tedious procedure; indeed, every patient finds it grateful and most of them will immediately complain if a careless assistant walks between him and the fan.

The injection of itself is by no means the most disagreeable feature of the whole procedure, if gently and properly done; but it is a hard table, an uncomfortable posture or fatigue that have most to do with wearing out the individual's patience. With this in mind no really expert manipulator will closely confine him until it becomes absolutely necessary to do so, and then will release him at the earliest possible moment. In order to prevent any wait on the table between the injection and the operation it is a good plan to have all draping of the patient and other preparation of the field done before the infiltration begins. If one employs a nerve block or other form of anesthesia, requiring an interval of delay before the effect is secured, the initial stage of the procedure should take place before the individual is put on the operating table. It is often an excellent idea after the incision to keep him informed of one's progress; then if he happens to be acutely attentive during the operation a display of the specimen may interest him to the extent that he will be content during a time-consuming closure or some other unavoidable but essential formality.

It may not be amiss to deal for a moment with some of the causes of failure in the use of local anesthesia. In many instances, of course, this is simply a matter of not having the proper solution injected into the right place. On the other hand the solution may be all right, the injection properly done and still one of the psychic phases of the subject may be so mishandled as to negate the result.

There are many ways in which the fluid may be improperly prepared. It must not be too old; it must not have been boiled more than once; the adrenalin must not be forgotten and it must never be boiled; also the adrenalin is decomposed if it is added while the solution is very hot; physiological saline must be used as a base for the solution and the water of which it is made must have been freshly distilled for reasons which are perfectly well known.

It is well before beginning any infiltration to very lightly scratch the intended line of incision. As a result of experience one easily acquires the ability to make a more or less faint red line without scratching deeply enough to cause pain. If one infiltrates a well-marked area it is hardly possible to transgress its limits later and cut, prick or retract tissues which have their normal sensibility. Many operators employ one or more wheals for the introduction of the large needle. I prefer to frost a skin area with Kelene spray, then lift up a furrow and pierce the skin at exactly right angles to its surface with the deep injection needle at once, thus sparing the patient the making of painful wheals.

The length and size of the needle should vary with the work at hand, details which are readily found in all the works on local anesthesia. I shall state in passing that the hypodermic syringe and needles have no place in this work because they are entirely too small. I find a 10 to 20 cm. syringe, with a three-inch twenty-two gauge needle, very useful for the average injection. If the needle is not too sharp or too fine pointed one can very readily distinguish by feel, after a little practice, the various layers through which he passes it.

The tension on the injected tissues must never be increased too rapidly nor muscle sheaths be treated at all roughly, since, as above noted, they are extremely sensitive. One who has a due regard for individual peculiarities, who watches the patient, senses his feelings and pauses as soon as pain is evinced, will succeed in completing an injection which might be impossible in the hands of a rough and unsympathetic operator. It is good practice to infiltrate the deeper tissue layers in a field, first, because in this way one acquires a certain amount of anesthesia in the overlying planes even before he injects them; then, too, the identification of deeper structures is vastly less difficult before a marked artificial edema of the superficial layers has been created.

Circular Block vs. Direct Infiltration. It is impossible to make direct comparison between the value of infiltrating an incision line and that of circumscribing it with a barrier of fluid, intended to desensitize the entire area through which the incision is made without getting any fluid into the operative field. There are certain different indications for both procedures in my mind, although some operators of experience seem unqualifiedly in favor of one or the other extreme for every case. If there are no contraindications I am inclined to use direct infiltration of the incision line in every hyperesthetic individual or when time must be saved for any other reason. This procedure is much the shorter of the two; there is no wait after the injection, also the anesthesia is more reliable in many cases. There are also a number of self-evident local as well as the foregoing general grounds for direct infiltration. If a wound is to be left open, if a fistula is to be created, a drain left behind or a pack employed it is difficult to see why a direct infiltration is not as good as any other. If a wound, for any cause, is likely to become infected the simpler procedure is distinctly the better one to use.

Frequently a wide area of the abdominal wall is hypersensitive, as for instance, the region over an inflamed gall-

bladder. If for any reason a local anesthetic is to be used here it seems logical to make the line of injection as short as possible, hence a direct use of procain in the incision area is chosen. On the other hand I inject a circular barrier in the treatment of malignant diseases. As a matter of course one should not risk metastases by inserting a needle-point into the immediate vicinity of any such lesion. The same method is employed in the treatment of an acutely inflamed area, as, for instance, a carbuncle. Direct infiltration of such tissues is just as painful as the incision itself, and at the same time may further increase tension in an acutely inflamed area, something which is very likely to result in opening up new fields to infection. It is a very easy matter to create a circular barrier around any part of the midline of the anterior abdominal wall. This, however, becomes increasingly difficult as we get away from it, hence the indication here seems reasonably clear, viz.: to make more and more use of direct infiltration the farther we are from the midline. If there is any local reason for not infiltrating directly the lateral abdominal wall I should recommend a paravertebral nerve block rather than a circular barrier.

Nerve-Blocking. The epoch marking work of Victor Pauchet should be known to every surgeon who has an interest in regional anesthesia by nerve-blocking. It is not possible to generalize very extensively regarding this division of the subject, since an individual technic for each such operation has, as a matter of course, to be based on more than a passing knowledge of peripheral nerve anatomy. It may be stated in general that the nerve or nerves supplying the region in which an operation is to be performed are injected with 1 or 2 per cent. novocain-adrenalin solution. (We find 1 per cent. efficacious, although 2 per cent. is used by most operators.) The desired nerve is identified by the paresthesia created when a needle-point strikes it or using an insulated needle, by the electrical stimulation of a mixed nerve, causing a contraction in the muscles supplied by it. A few cubic

centimeters of the above-mentioned solution creates in fifteen to thirty minutes, a complete anesthesia which lasts for something like two hours.

The different regions of the body are amenable, in the writer's opinion, in different degree to this form of treatment. By way of mentioning a few with which I happen to be somewhat familiar, will say, first, that the neck, generally speaking, presents a most fertile field for this sort of work. Blocking of the third or fourth cervical nerves at the points where they issue from between the vertebræ is accomplished with remarkable ease and gives so perfect an anesthesia over the front and sides of the neck that any operation at all may be accomplished with the utmost satisfaction to the operator and the patient. Nothing in the whole field of anesthesia is more satisfactory, for instance, than a thyroidectomy done in this manner. Of course, there is one theoretical risk in making such an injection on both sides of the neck at once, although I have never seen any evidences of it in practice, viz., it is conceivable that one may block and put out of commission both phrenic nerves at one time, thus causing sudden death, a possibility which must be kept in mind.

The major surgery of the chest wall and thoracic contents under regional anesthesia has not been so satisfactory in my hands as I should like. Minor operations, such as drainage of the pleural cavity, can be very easily done, but even here I believe that an infiltration of the field is simpler, quicker and in every way more satisfactory. When it is a matter of opening the pleural cavity widely there are physiological considerations which demand a general anesthesia. A consideration of them here would lead us too far afield; however, they are fully explained by Sauerbruch in his textbook on *Thorax Surgery*.

I have done a radical breast operation under a combined regional and infiltration procedure, but do not recommend it at all when a patient can take a general anesthesia. One must block the brachial plexus, practically all of the dorsal

nerves and then create an enormous barrier around the entire field, a procedure which is so difficult and time-consuming as to practically double the surgeon's work and the patient's load.

In abdominal surgery the question of regional anesthesia assumes a complexion all its own, which is not encountered elsewhere in the body. My experience leads me to feel that this is the field of all others for the combination of local, regional and partial general anesthesia, since we have here to do with cerebrospinal nerves as well as with the sympathetic and vagus as far as the conduction of various pain sensations is concerned.

Nothing is simpler than to get through the abdominal wall with one of the forms of infiltration or nerve-blocking. But the parietal peritoneum outside the affected area is extremely sensitive, while traction upon any viscus in the abdomen causes such suffering as to make a patient uncontrollable. (The sympathetic nerves in the various mesenteries always accompany the bloodvessels. As is perfectly well known, cutting, crushing, burning, etc., of the abdominal and pelvic viscera cause no pain.) Packs cannot, in view of what has been said, be inserted and withdrawn nor extensive exploration made after a local anesthesia which may have been sufficient for the opening of the abdominal wall alone. In view of the fact that Victor Pauchet finds it necessary to inject twenty-two dorsal and lumbar nerves in order to surely anesthetize abdominal wall and contents, for work on both sides of the midline, I believe it would be pretty generally admitted that there is no rivalry between local and general anesthesia for bilateral abdominal operations.

On the other hand, these two forms of anesthesia surely supplement each other here as they do nowhere else. It seems, therefore, reasonable and logical, if there be any ground to minimize the quantity of ether, to open the abdomen under local anesthesia, then later use as much gas or ether as the patient's reaction to pain demands. A

general anesthesia is very quickly induced under such circumstances; there is practically no excitement stage while going under or coming out, and only a superficial degree of ether anesthesia is required.

A most satisfactory combination is the following, which I may say is the standard in our clinic: To give a quarter grain of morphin thirty minutes before the operation, then after the patient is entirely prepared on the table and everything is ready we begin an ether anesthesia and the infiltration at the same moment. By the time the wall is infiltrated and the opening made the patient has sufficient ether for us to explore, pack off and draw up into the incision the desired viscus, at which point ether is discontinued. This we regard as one of the peaks of the procedure. The patient frequently wakes up, but rarely moves during the progress of the manipulation, provided, of course, that no pushing or pulling be entailed. He bears now what is termed a normal load under the slight general influence of morphin, novocain and residual ether until the second peak is reached, by which is meant, in this instance, the removal of packs when it is absolutely necessary to give a second small dose of ether. If the anesthetist is given half a minute's warning the whole procedure goes smoothly and there is no break in the technic or interruption at any time. After the packs are out ether is permanently withdrawn and the abdomen is closed with the patient's coöperation in many instances, and certainly without his opposition at any time, since there is never any of the forced respiration which makes it so difficult at times to approximate the deeper abdominal layers of a patient who is stimulated by ether, or cyanotic from its use, and subconsciously fighting for air. The novocain infiltration suffices to make the closure absolutely painless.

I have been impressed more than once by the fact that a second operation, a perineorrhaphy for instance, may be done with almost no ether, and with no local anesthesia at all, after one of these abdominal operations under the combined

method as described above. Abdominal work in general is better done under combined anesthesia than under the regional form which involves the blocking of twenty-two spinal nerves; however, certain local fields may be invaded, as, for instance, kidney and biliary passages, by the injection of only eight nerves, which is a number well within reason. When one considers that these organs often present a parenchymatous involvement which makes ether dangerous it seems reasonable to operate on patients so afflicted under nerve block.

For the sake of completeness one may, in passing, mention visceral anesthesia secured by injection of the great ganglia and plexuses high in the posterior abdomen, though lacking experience with it. It is highly probable that a glance at the anatomy of this region has been sufficient to deter many another investigator, as it did the writer, from attempting pioneer work in this field.

A form of regional anesthesia which gives us the greatest satisfaction is that secured by the trans-sacral route. Here we go directly through the ten sacral foramina from behind and block the anterior branches of the sacral plexus. This enables us to do anything on the viscera in which the gynecologist, urologist and proctologist are interested, keeping in mind that the anterior abdominal wall is not affected.

The extremities, as one might readily suspect from their anatomical characteristics, furnish the most fertile field of all for the use of nerve-blocking. This has been a matter of such common knowledge, ever since the epoch-making experiments of our own Matas and Crile, that a further discussion of it would be superfluous. We doubtless have Dr. Matas to thank for the inspiration which culminated in his pupil, Dr. Allen's invaluable contribution to this department of surgery.

Suggestions Evolved from Author's Experience. 1. It occurred to us long ago that a large amount of fluid used in infiltration increases the patient's intake in a very

definite manner and without causing discomfort. This reasoning was carried to the extent of gradually increasing the amount of fluid while decreasing the percentage of novocain from $\frac{1}{2}$ to $\frac{1}{16}$, by virtue of which we now administer any desired quantity of fluid by hypodermoclysis without inducing any real suffering—in fact, the procedure attracts very little attention in many instances.

2. It is stated in Braun's epoch-making work on local anesthesia that the gall-bladder is a forbidden field. It may be worth while to mention in this connection that the writer has repeatedly drained the gall-bladder and removed deeply seated stones without discomfort to the patient, after aspirating the bile and then replacing it with 5 per cent. cocain for a very brief period. This, of course, followed a simple infiltration of the abdominal wall.

3. I have injected the anterior sacral nerves with the abdomen open, under ether, for the performance of second operations on the rectum, anus and external genitalia. I do not believe it is even necessary to strike the nerves with accuracy, as one gets a fair regional anesthesia by merely making a massive injection under the soft tissues covering the hollow of the sacrum, thus causing fluid to suffuse everything in the neighborhood of them. One saves a large amount of ether while the abdomen is being closed under infiltration and during the period of preparing a second field for operation on the organs mentioned.

4. I might by way of repetition stress the plan used so frequently in our clinic of beginning infiltration and ether at the same time, then doing a laparotomy and employing no more ether during the rest of the procedure except when the patient shows unmistakable signs of needing it under peak load.

Conclusions. 1. It is to be definitely understood that ether by the drop method is the anesthetic of choice in our clinic for major surgery in general and local anesthesia in some form for minor surgery. But we go much further than this, hence an attempt has been made in this address

to deal with the large number of special considerations which do not fall into either one of the above-mentioned classes.

2. One must always keep in mind that local anesthesia has definite limits which are not to be transgressed. I have attempted to make many of them clear.

3. I believe that with increasing experience and better training we shall some day have to establish indications for general anesthesia rather than for local, as is the common experience today. It will then seem no more reasonable to anesthetize the entire organism for a strictly local operation on it than it does at the present time to bind or splint the entire body for an injury to an extremity.

4. Surely no one will advocate the use of local anesthesia to the point of interfering with the smooth and rapid conduct of a surgical procedure.

5. It may be safely stated that the anesthetization should never be larger than the operation; for example, one should not, under ordinary circumstances, attempt a radical breast operation, nor, it seems to me, any one of the larger abdominal procedures which involve both sides of the midline, under local anesthesia alone.

6. The operator will have to train himself especially for this work if he expects to be successful in it, although in a busy clinic it is unquestionably the correct plan to have one associate who has this phase of surgery wholly in his hands.

7. There is, to my thinking, a very definite field for the local anesthetist. I am sure that such an individual should play a role similar to that which is well known in general anesthesia. His services should be in demand by the surgeon, who makes only an occasional use of these methods, or by one who is not temperamentally suited to the acquirement of them. I have been so fortunate as to profit by the accomplishments of my assistants, Dr. Sam F. Wennerman and Dr. William Murray Winn, to whom I am indebted for most of my local anesthesias in recent years, to say nothing of much of the enthusiasm which I have acquired for this subject.

THE SEMI-CENTENNIAL OF THE INTRODUCTION OF ANTISEPTIC SURGERY IN AMERICA

By Henry O. Marcy, M.D.
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The present seems a fitting opportunity for the presentation of this subject to your learned association of surgeons. Dr. Horatio R. Storer is now living in New York City and is a remarkably well-preserved man of ninety-two years. He is the oldest living graduate of his class in Harvard. Dr. D. Humphrey Storer, of Boston, his father, was professor of obstetrics and diseases of women in the Harvard Medical School during my student days. In the better sense of the word he was a self-made man, having by his own exertions defrayed his expenses during his student period. He determined his son should be better educated. Horatio graduated classically in medicine and at the law school, since medical jurisprudence was thought by his father to have been comparatively neglected as a part of good medical training.

This long curriculum was not considered sufficient; his father obtained the entrance of his son into the family of Sir James Y. Simpson, then the leader, as a teacher of the diseases of women, in the great University of Edinburgh. He remained as a member of Prof. Simpson's family for four years, and in conjunction with Dr. Priestly, of London, wrote the life of Simpson, published in two volumes.

I have ever felt grateful to the Drs. Storer, both father and son. For a considerable period before the latter's severe illness I was his surgical assistant. At this time he was supposed to have the largest practice of any surgeon in Boston, with an income of $40,000 a year. With Drs. Kimball and Burnham, of Lowell, he shared the honor as a leader in New England in the performance of laparotomy. Although his work was unexcelled in this department of surgery by any of the specialists of America, very naturally he had his bitter critics. I shall never forget the severe and most unwarranted statements which followed an operation, the details of which he published for the cure of a large umbilical hernia.

One of his most noteworthy contributions, which at that time could never be fully appreciated, was his treatment of the pocketing of the pedicle of ovarian tumors. He even did better than he himself knew, since he not alone controlled the hemorrhage of the pedicle, but also by this procedure he closed the abdominal cavity without drainage, the importance of which had not then been appreciated.

Dr. Storer published the *Annals of Surgery*, which for seven years had a wide circulation. These seven volumes will add value to the library of any specialist today. He soon after this was taken very ill from an infected wound, narrowly escaping with his life, and was obliged to retire from active practice and from the promise of leadership in his department in America. Dr. Storer arranged for me to spend the summer of 1870 with Sir James Y. Simpson. Sir James died while I was yet in London, notwithstanding which I determined to spend the summer in Edinburgh. Soon after reaching the city I sought to profit by an introduction to Mr. Syme. I learned that this distinguished surgeon was very ill and a few days later I attended his funeral. A friend pointed out to me, as one of the chief mourners, a man of medium height; accompanying him was a tall lady in deep mourning. He said: "This is a Mr. Lister, who has recently come from

Glasgow. He has been appointed a teacher in clinical surgery through Mr. Syme's influence, whose daughter he married." Then my friend, a young physician of Edinburgh, volunteered to advise me that I do not seek Mr. Lister's acquaintance, who is not in good repute here in the medical profession. He has some new and strange ideas attempting to prevent the putrefaction in wounds. Curiosity, rather than any thought of obtaining knowledge, caused me to ascertain something of the new teaching. Upon the presentation of my card I was very courteously received by Mr. Lister, who spent the morning with me in a painstaking explanation of his methods, with the demonstration of the result of his operative procedures. I was especially impressed with two cases of resection of the elbow-joint in strumous children, very probably tuberculous infection. The wounds were without pain or swelling, and the little unfortunate patients showed slight evidence of suffering. To me the demonstration was complete and convincing.

My reception in Edinburgh had been exceptional. The leading men had been most kind. The famous Professor Bennet received Mrs. Marcy and me in his family as old friends, and afterward when we were at the Lakes, during our studies of Northern Scotland, Dr. Watson, professor of surgery, gave me a personal history of a number of the leading men of Edinburgh. Dr. Keith received us into his family, and he, as did Sir Spencer Wells, made great emphasis upon strict cleanliness in surgery. In this way they emphasized the then unknown value of aseptic surgery. Mr. Keith showed me his sponges and stated that these had been under the special supervision of Mrs. Keith, who had prepared them for use in his then unbroken series of seventy laparotomies without a death—at that time the world's record.

It is needless to say that the summer spent with Mr. Lister and my daily association with him was most profitable. I thought, in a general way, I had mastered surgery, both as a science and an art, before visitingEdinburgh. Immediately

upon graduation I entered the U. S. Army in the Civil War as an assistant surgeon, and, far beyond my merit, was rapidly promoted: surgeon—of a regiment; of brigade; of division; departmental surgeon and medical director. As my last duty, under the special personal instruction of General Sherman, I made a sanitary renovation of the city of Charleston, in a house-to-house cleaning, with five hundred men and carts, in a most thorough manner. Upon my return in June, 1865, at the close of the war, I was appointed assistant in the medical department of Harvard to the distinguished Dr. J. B. S. Jackson, the leading pathologist of America, and the equally distinguished Dr. Henry I. Bowditch, professor of clinical medicine, both of Boston. In the spring of 1868, three years later, I relinquished my positions and an already large private practice and entered the University at Berlin, Germany, profiting especially by six hours a day laboratory work under Prof. Virchow and the instruction of Prof. Lagenbeck in surgery and Prof. Martin in diseases of women.

I outline this early period of my history briefly in order to show that I was in a receptive mood to profit by better instruction. At the close of my first visit to Mr. Lister I said to him: "Until this morning I thought I knew surgery. You are certainly introducing new fundamental principles of wound treatment which appear to me revolutionary and valuable; permit me to be your special pupil for the summer."

It thus happened that I became his first American pupil. A delightful summer was most agreeably and profitably spent. Personally, Mr. Lister was a man of medium stature, quiet and retiring in appearance. He had a slight hesitancy of speech which, at times, in a way impeded a clear expression, although his manner was earnest and forceful. He was most serious in his thought and rarely given to levity. I was quite conscious on several occasions of having transgressed his sense of propriety in my free American semi-boyish manner. I do not now recall a single instance in which Mr. Lister relaxed from his usually grave and serious deportment.

The intensity of conviction, which is said to be a dominating factor of Scotch character, was daily apparent in the personal contact of many of the professors. I have seen them pass and repass Mr. Lister time and again without recognition on the part of either, although each was especially well known to the other. I ventured one day to ask Mr. Lister how it could be possible that cultured, refined gentlemen could be so intensely antagonistic. With a tinge of bitterness, as if the query was unwarranted, he replied: "Are the members of the medical profession of Boston immaculate?" To which I replied, with a merry laugh, that now I was reminded, for the first time, that the only surgeon in Boston with whom there had been an active controversy was my friend Dr. Storer, who had been educated in Edinburgh.

At this time he had very few students and not more than three or four men of special promise. He one day complimented me by saying to them: "Why do you not follow the example of Dr. Marcy, whose note-book is ever in evidence, and little escapes his notice?" On another occasion, when showing us the result of removal of a mammary tumor where the union was primary without suffering, evidently having in mind his recent illustrious patient, none other than Queen Victoria, he said: "What would they now say if this patient had been a Princess of the Realm?" I know I hurt him, since he took it as a seeming rebuke when I replied: "Oh, Mr. Lister! What a pity you do not practice surgery in America, where every patient is a King or a Queen!"

The great field of wound infection contained far too many factors for easy solution. He believed the common cause of infection was his so-called "aërial germs," which were omnipresent. This was most natural, since his first experiments, as are well known, were the putrefactive changes which take place in most substances exposed to the air. His first convincing experiments were with open-mouthed flasks, a portion of which had the opening bent downward so as to prevent atmospheric contact. Various albuminoid solu-

tions which had been sterilized by boiling had been introduced. Those which were upright speedily received atmospheric contamination, with the consequent fermentative decomposition, while the albuminous solutions, where the neck of the flask had bent downward, had remained sterile. Thus was permanently settled the hitherto discussed unknown problem of the chemists of spontaneous decomposition. Of course, such changes took place as a result of so-called atmospheric contamination. My old teacher, Prof. Jeffries Wyman, of Harvard, had settled this problem years before by hermetically sealing in glass various fluids that had been sterilized by boiling, in which no changes had taken place.

These basic principles were the foundations upon which Mr. Lister first formulated his methods of antiseptic surgery. It was on this account that he determined, first of all, to sterilize the atmosphere of the surgical field and hence the steam atomizer which he devised where the carbolic spray was believed to be the effective agent. The wounds were then dressed, as we all know, with various forms of antiseptics, chiefly carbolic solutions. In my early period carbolized lac-plaster was believed to be very important, and his sutures, first of silk and afterward of violin strings, were impregnated with a 10 per cent. mixture of carbolic acid in melted white wax.

He also put up his ligatures in strong carbolized oil. He never used sutures, except as the interrupted stitch, taken in the time-honored way, through and through the external structures. He advocated and used the ligation of arteries with carbolized catgut, which he recognized as absorbable when buried in the wound. Before leaving Edinburgh he furnished me, at my request, a large quantity of surgical dressings and catgut, which puzzled the Custom House officers in Boston, to ascertain under what subdivision the material was dutiable.

I returned to Boston with the fixed purpose of devoting my life to the use of Mr. Lister's principles in the treatment

of wounds. I thought I saw, however, a great field for the further advancement of their application. Several times afterward I visited Mr. Lister, during the subsequent years, always to me of pleasure and profit.

Before leaving Berlin, Prof. Virchow, at my request, obtained for me one of Hartnack's especially made microscopes, who was then supposed to be the best optician in Europe. This great cellular pathologist insisted upon it that the clear differentiation of the cell was the chief end to be obtained in the microscopic investigations, and that higher powers than a quarter or a fifth were only confusing to the picture. Rather reluctantly he permitted me to add a one-seventh objective. Soon after my return, in 1870, my lenses were all stolen.

My late friend Prof. Niles, of Cambridge, was about returning from Germany and purchased for my laboratory use eleven objectives, including one 1—14. They were made by Zeiss after the Abbey formula, which greatly increased the illuminating power. This introduced me into a new world of microscopic exploration. The so-called Brownian movement, which had been a puzzle to many investigators, was now easily solved and the microörganisms became clearly differentiated. Sometime later I added to my equipment, becoming the fortunate owner of one of Tolles' special microscopes, also adapted to photomicrography. With it I obtained one of Tolles's celebrated objectives and one of Wales's immersion lenses, each of one-sixteenth. This splendid equipment was utilized in my bacteriological investigations, which in other directions was also complete.

In my enthusiasm I quite forgot that I was the pioneer in America of the new faith of the so-called antiseptic surgery, and that my great chief, who had been a comparatively unknown man, was without the approval even in Edinburgh of a single prominent surgeon. Dr. Henry J. Bigelow, of Boston, was the leading surgeon of New England. Most naturally I sought his council and enthusiastically explained

Mr. Lister's remarkable discovery and practice. He asked me to send over my equipment to the Massachusetts General Hospital, stating that there might be something in it and he would test it. Dr. Bigelow was a man of careful habit, but he prized his special operating coat, which he had used for some years, the front of which was varnished with the dried blood of his previous experiences. Very naturally the wounds made were infected, and then he declared that it was only another fad, unworthy of consideration. His judgment was considered final and the subject not worthy of consideration.

Much to my surprise I found myself the subject of severe criticism. I was completely out of touch with my former associates. Some of my friends had applied for me, for the position as assistant surgeon in one of the large Boston hospitals, which failed of approval because of my advocacy "of a foolish technic promising to revolutionize surgery." Our local medical journal refused me their columns and certain of the medical societies severely criticised my contributions. This aroused in me what I considered a just indignation, and under its influence I refused to accept a choice of professorships in Chicago, Brooklyn and Ann Arbor, determined that my field of operations should remain in Boston. This stimulated immediate and redoubled effort. I built a private hospital in Cambridge and established a laboratory with three most excellent assistants—Drs. A. P. Holt, late Surgeon U. S. Army; Samuel A. Nelson and E. W. Cushing—for original research work in bacteriology. The field was new and we were all four most enthusiastic. For more than ten years this work was continued at large expense in connection with my private hospital, which was erected under special designs. My assistants are now all dead. Dr. Holt was Surgeon-General of Massachusetts at his death. Dr. Nelson was in active practice at his death and Dr. Cushing was professor of surgery at Tufts Medical College and surgeon in one of our large hospitals. In this connection, and it is

only a just tribute of affectionate appreciation, I emphasize the ever-faithful and competent service of the sisters Frances E. and Ella Yandell. Much of my success has been due to their faithful coöperation. The elder sleeps quietly in my lot in Mt. Aburn after thirty-four years on duty in chief charge of my hospital. The younger sister is still my assistant.

In my early surgery I was remarkably fortunate. There had been a number of laparotomies in Cambridge but not a single recovery. The first successful case was my patient, a large ovarian cystoma. Convalescence was rapid and recovery complete. I removed the first large uterine myoma operated upon in the Cambridge hospital, and only very recently she called upon me. My list rapidly increased, and the mortality rate, which had been considered in New England 40 per cent., rapidly fell to 4. Criticism, however, was not wanting. The opening of the abdomen for any cause was considered an unwarranted operation. Fortunately I was never thought untruthful, but the explanation was given: "Marcy is a lucky dog, he picks his cases." I invited inspection of my work and subsequent results to any who were interested. Little by little our technic was greatly modified. The carbolic spray, which had been introduced by Mr. Lister after my pupilage, was slowly abandoned. On one occasion Dr. Kimball, of Lowell, who was anxious to see some of my earlier work, was so distressed by the use of carbolic spray that he was obliged to leave the surgery.

At about this earlier period of the seventies, Dr. T. Gaillard Thomas, of New York, whose student I had been, invited me to be present at one of his operations, conducted under the Lister technic. The operation had been carefully staged. The amphitheater had been railed about to separate the patient and staff from close contact with the student body. Two steam atomizers were in active operation impeding the vision. The operating room was unusually hot and in a moment of abstraction Dr. Thomas seized a towel and vigorously rubbed the perspiration from his face and hands,

throwing it to one side and automatically proceeded with his work. The emptied cyst of a large ovarian tumor, without adhesions, was easily extracted from a comparatively small wound; the pedicle ligated and the operation finished with seeming promise of an easy recovery. When alone, he asked me for my criticism of the operation, which seemed to him most satisfactory. I complimented him upon his skill as an operator and asked him if he really desired more, to which he replied: "Dr. Marcy I have invited you to come from Boston for my special instruction as Mr. Lister's pupil; I desire you to instruct me in his technic." I then pointed out to him the possible hand infection, from the towel automatically used. I was, however, surprised a few days later in learning the death of the patient from infection.

When in Edinburgh, Dr. Bennet declared to me his conviction that cancer was first local and probably disseminated through the lymphatics, and that, as a consequence, it was of the greatest importance to operate early and with great care to remove all glandular enlargements. The general teaching up to this period had been that cancer was a constitutional disease and that operation at the best was only a palliative measure of relief. Convinced of the correctness of Dr. Bennet's opinion I have since surgically fought cancer as the fire department does fire, with the conviction of having saved many lives. In one of my earlier studies I made cultures from material carefully taken from mammary growths. It was not difficult to differentiate a coccus, which in repeated cultures, bred true, but they were not reproduced by the inoculation in animals. At this time I had been made aware of the sad experience of one of our younger members of the profession. The patient had developed a malignant growth of the face, requiring frequent dressings. On one of these occasions, incontinently he rubbed his own face and inoculated a small abrasion. This was thought little of until later it spread rapidly and cost his life prior to that of his patient.

In one of my lectures I narrated my experience, regretting that the state should execute its murderers rather than making them subjects of scientific investigation. The Society for the Prevention of Cruelty to Animals investigated me, expressing their indignation that Dr. Marcy, who had for a long time kept in his garden a menagerie of animals, the subjects of torture, should at last seek to prey upon his own species.

Just at this writing I learn of the death of my old friend Dr. Carstens, of Detroit, from inoperable cancer of the mediastinum. He has long been a disciple of early operations for cancer and only recently urged that the medical profession set aside one day a year in teaching the public the danger of delay in operations. Little by little surgical technic has been mastered with automatic correction not unlike the Church ritual.

The American Medical Association was utilized by me to the uttermost, year by year, for quite two decades in contributing to its members the latest and best fruitage of my labors. To this and other societies I contributed several monographs annually, many of my experimental studies with more than usual interest, still clinging to my great master's teaching that aërial contamination was the more common cause of infection. Besides the usual routine of cleanliness, now everywhere adopted, we filtered the air for some years, just prior to the operation, by the shaking of sheets wet with bichloride of mercury solution 1 to 1000 until the air was moist and all dust allayed. I still think this is a simple and effective measure, especially in the preparation of a living room into an improvised surgery. I then, for a long time, used a machine for conveying through a large tube over the site of operation air filtered through a double layer of finely carded wool. We next, for a considerable period, made use of, with satisfaction, oxygen gas conducted through a tube over the operative site. The special reason for using this sterile gas was of its greater specific gravity, replacing the air.

Later, it was determined that the greatest danger from bacterial infection came from the hand of the operator. Then followed a variety of methods of disinfection: the soaking of the hands in a strong solution of permanganate of potash, until they became a dark brown tint, and afterward immersed in a solution of oxalic acid, restoring the hand to its original color. Although I suffered far less from this painful process than several of my associates, the memory of this discomfort is still very vivid, especially if the process was repeated oftener than once a day. It was noted that this bleaching beneath the finger nails was seldom complete and cultures from the epidermal cells demonstrated several varieties of bacteria. This led to the introduction of the silk glove which, when immersed in a bichloride solution, was supposed to furnish ample protection. My attention was called to a rubber glove made in Providence, R. I., composed of pieces united by a rubber cement. These in the main were satisfactory, but they were soon superseded by a glove produced by a dipping process, a mold being thus covered by different layers of rubber, usually ten or fifteen, until a sufficient thickness was obtained. These furnished a most satisfactory protection, but they necessarily had a fault of a perfectly smooth surface, which when wet was very slippery. There followed a long period of experimental studies to overcome this objection by roughening the mold, but this caused the rubber to adhere with a destruction of a considerable portion of the product. After three years of experimental study the Miller brothers, of Akron, Ohio, produced the very satisfactory "never-slip" glove. They urged me to patent this process, which I refused, feeling that it was improper to obtain a pecuniary profit for anything that could serve the medical profession. They offered me ten cents a pair royalty, urging that this would serve as a protection to the quality of the product. Some years later they wrote me that the royalty would now amount to one hundred thousand dollars a year, since their annual output exceeded a million of pairs.

At this early period, when operating in one of the large Boston hospitals, I found my supply of chromatized catgut, which I obtained from Mr. Lister, was nearly exhausted. In the operating room a bottle of catgut ligatures was opened, recently sent me by one of the London firms. The wounds of all three patients developed a streptococcal infection, with one death and two slow painful recoveries. Our laboratory investigation showed streptococci in the catgut from which the cultures were made. This led to a careful study of animal ligatures, with the effort to obtain better suture material. Mr. Lister's studies of catgut will ever remain a monument to his honor. He first used violin strings soaked in carbolic acid solution to which a very small amount of chromic acid was added as a tanning process.

In a sense I was more fortunate than my great master, since a careful research of the literature of an earlier period of study showed that this subject was by no means new. Dr. Jameson, of Baltimore, published a prize essay in 1827 for the preparation and use of the animal ligature in surgery. In the hands of this operator his animal ligatures were demonstrated as safe and far superior to silk or linen. They were used to a very considerable extent by some of our best surgeons of Europe and America, but lacking the key which Mr. Lister discovered of the causes of wound infection, they naturally fell into disuse and were forgotten. The list of experimental studies published by Dr. Jameson demonstrated that the result of ligation of the arteries in the calf, dog and sheep caused a permanent occlusion; that the foreign material was encapsulated by living cells and that ultimately the ligature entirely disappeared, leaving in its place a permanent reinforcement of connective tissue. Mr. Lister was utterly ignorant of the demonstrations of Dr. Jameson, and as the laws of England at that time were so framed that studies upon the lower animals, even of such an important character were not permitted, this great master was obliged to resort to France for the privilege of pursuing his investiga-

tions. His conclusions were almost identical with those of Dr. Jameson. So far as I am aware it had not occurred to any to make use of sutures deeply implanted in wounds, buried, until in 1870, when it became very evident to me that it was necessary for the purpose of curing hernia to close separately the different structures of the abdominal wall and to restore the inguinal canal to its normal oblique direction.

Based upon the knowledge of the animal ligature left *in situ* about an artery, it seemed a logical deduction that the tissues could be thus safely coapted. I instituted at once a series of comparative studies in order to ascertain if such suturing was safe and trustworthy. My investigations proved conclusively that aseptic animal structures buried in well-vitalized tissues were surrounded by leukocytes which, little by little, invaded the material used; were *pari passu* with themselves transformed into connective-tissue cells, taking, in a considerable degree, the shape and direction of the suture material. So noteworthy was this that at first I was constrained to believe that the suture material itself became revitalized as a sort of graft; but more careful observations demonstrated that the foreign material disappeared, leaving in its place a vitalized band of connective tissue, the resulting product of which in certain conditions proved to be of the greatest value, to wit, where the integrity of the parts are liable to damage because of tension, as in hernia and all wounded structures subject to special mobility. It gradually became evident that a careful coaptation of wounded tissues could be safely made, thus avoiding pockets of blood or serum, and, as a consequence do away with the use of drainage tubes, then supposed absolutely essential.

I can here only refer to my long chapter of research work which finally culminated in obtaining from Australia the tendons from the tail of the kangaroo. These are now in general use, and if the supply can be maintained, will probably altogether supersede catgut. The highest encomium

of approval of my discovery and introduction of kangaroo tendon sutures was, when, at the outbreak of the World War the British Government commandeered the entire Australian supply for surgical use, and only during the last year of the great contest I was enabled to supply the U. S. Army with several hundred thousand.

The comparative anatomists in a general way gave no description of the tendons suited to my purposes. I thought the tendons from an old cow's tail in "fly time" would be excellent, only to find there was a tendon scarcely two inches long. I knew that the Indians sewed their robes and skins with tendons, which made them much more durable than the use of linen thread. I went to the Sioux Country in the Great Northwest and was taught the art by the Indian maidens. They obtained their supply of Nature's thread from the fascia lata of the foreshoulder of the buffalo. They were, however, ill adapted for surgical uses, and although, of course, very strong, they frayed very easily. Tendons from the tail of the whale were obtained four feet long and strong enough to draw a cart, but were equally undesirable. Tendons from the hind leg of the caribou and moose were much better adapted for our purposes, and for a time I used them with satisfaction, but they also lacked eveness of structure. My attention was called to the tail of the squirrel and the rat and later to the opossum. In all I found that the psoas muscle was multiple, with a separate tendon extending to the very extremity of the tail. The knowledge that the kangaroo was a marsupial was my inference that the kangaroo should have a similar anatomical construction.

I then had under care a retired Australian merchant. He only knew that the tails of the kangaroo made good soup, but his son was still in business in Australia and he would obtain specimens for me. These were sent me in 1881, and I have never obtained finer specimens. They were from the species of kangaroo called the wallaby. The larger variety of these species are of similar construction, but the tendons

are so large that they require splitting, and unless great care is exercised they are not even and of uniform strength.

Painstaking bacterial studies demonstrated that Mr. Lister's so-called germs consisted of a considerable variety of independent organisms with different virility and activities of production, some of them producing far more dangerous effects than others. The shape elements caused a general classification of these bacteria into bacilli and cocci. Very slow progress was made in the general acceptance of Mr. Lister's teaching, and not until 1875 was favorable notice obtained and Mr. Lister's germ theory accepted in Germany. The mortality rates following the Franco-German War were frightful. This caused a special attention to wound treatment. Von Nussbaum, of Munich, disinfected his wounds carefully with carbolic acid. In 1873, 50 per cent. of hospital surgical patients were attacked with gangrene. The improvement was so great by the use of carbolic acid in von Nussbaum's clinic that he called it "Lister's great discovery." Of 75 of his patients suffering from compound fractures all recovered without the loss of limb. Of 139 patients upon whom amputation was performed only 4 died. Soon after this antiseptics were generally introduced into Germany.

Mr. Lister first visited America in 1876 and delivered an address upon wound infections in Philadelphia at the International Medical Congress. His efforts, like my own, failed to develop any special interest. Drs. Van Buren and Stephen Smith, of New York, gave the antiseptic method their approval. For convenience of reference and to show the marked changes of wound dressings, I copy here from Stephen Smith's valuable work on *Operative Surgery*, published in 1879, the detailed technic then advocated by Mr. Lister: "Carbolic acid has proved thus far the most available antiseptic, as it may at once be used for disinfecting the wound, the air and for storage in the dressings. Though useful, however superficially but judiciously used, its full

benefit is secured only when it is employed in a systematic manner, with an intelligent appreciation of the objects sought to be accomplished at each step in the dressing. The following are the details when the dressing is applied according to the formula: Provide a vessel containing carbolic acid dissolved in water, 1 to 40, for the immersion of the hands of the operator, the sponges and instruments used in the wound; a steam spray apparatus, capable of giving a cloud of vapor; antiseptic gauze, open cotton cloth impregnated with carbolic acid 1 part, common resin 5 parts and paraffine 7 parts; Mackintosh (fine cotton hat lining) or gutta-percha tissue of good quality will also answer, but it is liable to wear into holes; drainage tubes (India rubber, with a silk ligature attached, or horsehair;) oiled silk protective (oiled silk coated on both sides with copal varnish and afterward brushed over with dextrine; when the copal varnish, has dried a mixture of 1 part of dextrine, 2 parts of starch and 16 parts of carbolic acid is brushed over; the acid soon evaporates); common oil silk smeared with the oil solution will answer the purpose pretty well, especially if used in two layers; carbolized catgut ligatures. Proceed as follows: Shave the parts, if there is much hair, in order that the antiseptic may not be prevented from acting upon the skin; wash the part with a watery solution, 1 to 20, to purify the skin; direct the spray upon the part and maintain its action and position during the entire operation and dressing without a moment's interval; immerse the hands, instruments and sponges in the 1 to 20 solution before operating, and at every interval, when not enveloped by the spray, by the 1 to 40 solution; tie all vessels with antiseptic catgut and cut the ligature at the knot; if the finger is to be introduced into the wound, take special care that it is an aseptic finger, and this is done by cleansing it with an antiseptic solution, making sure that it passes well into the folds about the nail. Instruments must remain in the antiseptic solution to penetrate any dirt or grease which may be concealed on them, as

between the teeth of forceps; sponges, though used in suppurating wounds, but thoroughly treated with carbolic acid solution, are antiseptically clean. First wash the cut surface thoroughly with a strong watery solution, 1 to 20; place the drainage tube or tubes so deeply in the wounds as to drain all accumulating fluids.

"The effusion of plasma which occurs during the first few hours after the infliction of a wound is greater when the cut surface has been treated with a stimulating wash than it is under ordinary management, and unless provision be made for its escape it will be pretty sure, in a wound of considerable depth, to accumulate in sufficient quantity to cause inflammatory disturbance from tension. When the antiseptic has left the wound the discharge will be trifling in amount unless the irritation is continued by blood or serum pent up in sufficient quantity to cause disturbance or by some other accidental circumstance exciting the nerves of the part. If the tube enters obliquely, cut the outer extremity obliquely and lay the retaining threads on the surface; if the wound is to be closed, as after amputation, use carbolized silk for sutures, as it is very superior to wire, not only on account of its perfect suppleness, but because its actively antiseptic character ensures absence of putrefaction in the track of the wound; the spray is never more useful than in the introduction of the sutures; if it be not employed the wound must be injected with lotion after the insertion of the last stitch, to destroy any mischief that may have entered through regurgitation of blood that oozes into the cavity during the sewing; if strapping is required, common adhesive plaster may be rendered antiseptic by dipping it for a second or two in a watery solution of the acid, and it is most convenient to have the lotion hot; the ends should be overlapped by the gauze; apply to the cicatrizing part a layer of the oiled silk protective, wet with watery solution and having a hole for the drainage-tube, for cicatrization is retarded when the acid is allowed to act immediately on the margins of the wound,

and it is therefore necessary to protect the part by interposing between it and the gauze a layer of some impermeable material; apply eight layers of the gauze of such size as to cover all the wound and the adjacent parts; in the situation where there is not as much extent of skin for the gauze to overlap as is desirable, as in the vicinity of the pubes, the deficiency of surface may be compensated by using the gauze in a thicker mass, say in sixteen to thirty-two layers; dip the first layer in the solution, for if the gauze were applied dry, some active septic particle adhering to its surface might enter the blood or serum at the outlet of the wound and propagate putrefaction to the interior; between the last two layers place a piece of Mackintosh of smaller size than the layer of gauze; apply the last layer so as to cover in completely the Mackintosh; this impermeable cloth is used to prevent the discharge from going directly through the dressing, because if a considerable quantity went through, the acid might all be washed out within twenty-four hours, and then putrefaction would spread inward to the wound; the Mackintosh having no antiseptic property, except mechanically by its impermeability, but, on the contrary, being like other indifferent materials covered more or less with septic matter, it is necessary when the dressing consists of more pieces than one that the Mackintosh be well covered in at the place of junction of the two pieces, for if it were allowed to project uncovered in the vicinity of the wound it might communicate septic mischief; retain the dressings by bandages of the antiseptic gauze, over which elastic webbing may be applied when the bandage is not sufficient, as in wounds or abscesses in the groin; inspect the wound on the day after its infliction, whether it be accidental or the result of the operation, and change the dressing only in case the discharge is liable to extend beyond the edge of the folded gauze; during the subsequent progress of the case leave the gauze undisturbed for periods varying from two days to a week, according to the diminution of the effusion; in redressing continue the

spray uninterruptedly on the part; while the bandage is being cut or removed, the patient or an assistant keeps his hand over the site of the wound, to prevent the dressing from rising *en masse* and pumping in septic air; in raising the folded gauze take care that the spray passes into the angle between it and the skin; remove the drainage-tubes, cleanse them in carbolic solution and before reintroducing them cut off such portions as the granulations in the wound render necessary to bring the external extremity flush with the surface of the skin; lay aside the gauze which is soaked, but use the Mackintosh again after cleaning it with carbolic acid solution."

At the International Medical Congress held in London, in 1881, we beheld with astonishment Dr. Koch's demonstrations of the Bacillus tuberculosis, the insidious unknown enemy which had for centuries decimated every generation. With equal interest Mr. Lister's great victory was won in the general acceptance of his discovery and the revolutionary benefits derived from his wound treatment, marking the great era in modern surgery.

Many of the leading surgeons of London gave Mr. Lister scant welcome to the great metropolis when he was appointed surgeon-in-chief to King's College. This opposition resulted in an organized effort to once for all minimize the dangers of wound infection and the value of Mr. Lister's antiseptic treatment. A very considerable number of the leading surgeons of London, Germany, France and America had made an organized effort to displace the "great supremacy of carbolic acid."

They had adopted as their slogan from Germany, "Fort mit dem spray." Mr. Lister's address held the central place in the surgical program. The day before I was requested to open the debate, considered of very much greater importance and honor in England than in America. I knew the significance of the situation and confess to the weakness in having spent nearly the entire night in carefully reviewing the entire

subject. The great hall was crowded with over four thousand delegates; a considerable number of whom heard Mr. Lister with much difficulty. I sat beside my distinguished master, Dr. J. Marion Sims, of New York, who as my name was called, whispered to me: "Now Marcy, for America's sake!" What I said I shall never know, but I have considered it the master effort of my life. This was a glad appreciation on my part of the debt which I owed to the guiding spirit and consecrated by the medical profession as the immortal master of modern surgery. In a general way, from this date, we may consider the problem of aseptic surgery settled and that, as we all know, in a way much simplified and effective.

Modern technic does not require description. Corrosive sublimate solutions have been generally adopted in substitution for carbolic acid. It is a much better germicide and is much less irritating to the tissues wherever applied. The modern sterilizer renders aseptic all instruments and dressings. The rubber glove assures safety to both surgeon and patient. All well vitalized tissues are evenly coapted and held at surgical rest by the continued absorbable suture. To avoid adhesions all lesions of the peritoneum are to be repaired with tailor-like accuracy. A fine subdermal suture evenly coapts the skin. This is held in fixation by the iodoform collodion seal and the resultant scar is reduced to a mere line, and oftentimes, after a little, detected with difficulty. On the exposed portions of the body, especially of the face and neck, the effacement of the former ugly scar secures the life-long gratitude of the patient.

I have recently written an article upon surgical technic which I close as follows: "The surgeon must not alone be a scientist, which includes a familiarity of the technic as outlined, to be carried out with the automatism of a well-mastered ritual; an equal knowledge of the structures involved and their relationship, but to this should be added almost equal acquirements, those of the *artisan* and the

artist." The work of the surgeon for good or ill has the finality at the single period of manipulation before the patient has left the operating table.

I last saw Mr. Lister operate in 1890, when we had a personal discussion upon the use of drainage tubes in antiseptic wounds, I maintaining that the serous exudate was of value and should be considered as "first aid to the wounded." He admitted the possibility of injury to be derived from drainage tubes, saying that he cut them much shorter and removed them much earlier than when I was his pupil. Soon afterward I visited Oberammergau to see the "Passion Play." A rainy, disagreeable day of waiting preceded. I spent much of this day in the dusty gallery of the old church writing a paper, "In What Class of Wounds Shall We Use Drainage?" It was published and republished several times in both continents. We occasionally corresponded with Mr. Lister, and when in 1892 I published my large quarto book on *Hernia*, I was delighted to receive his approval of dedicating the work to him, which is expressed as follows: "To Sir Joseph Lister this work is respectfully dedicated. In common with a grateful profession, I would acknowledge his monumental labors, which have revolutionized the surgical art. Especially am I indebted for the faithful personal teachings which were rendered to me, his first American pupil. Without the stimulus and profit received from his instructions this work would never have been rendered possible."

The world is never satisfied in the presentation of truth in a new form. Evolution must ever meet opposition. To the individual leader it means sacrifice in some form, not seldom death, and the great victory is often symbolized by a crown of thorns. Dominated by the inspiration of a deep, absorbing faith, such great spirits with unswerving purpose become heroes, if need be martyrs—the highest prototypes of the Great Master. In the establishment of a new government, our Washington, and in modern medical science Lister are the exceptions, having survived to enjoy the highest honors and receive the blessings of mankind.

POST-GRADUATE MEDICAL STUDY IN FRANCE

By Samuel Lloyd, M.D.
New York, N. Y.

The teaching of medicine in Paris began in the reign of Charlemagne, but it was not until 1260 A.D. that a faculty of medicine was organized. At first this faculty was a part of the Faculty of Arts, and while connected with the University, it remained under the tutelage of the church authorities, both masters and pupils being required to take holy orders, so that they often abandoned the study of medicine to follow the more profitable career of a church dignitary. Even after this rule was abolished they were still required to practice celibacy until 1452, when Cardinal d'Estouteville abolished this rule and permitted them to marry.

In 1456 Jacques Despart donated the money to purchase the building in the rue de la Bucherie, where the school was located for more than three centuries. This building is still standing and is now occupied by the "Association Générale des Etudiants." Opposite the medical school a rival institution, the College de Saint Come, was established and graduated a considerable number of killed surgeons. Ambroise Paré, who revolutionized surgery by introducing the ligation of bloodvessels, was one of its celebrated members. In the eighteenth century the importance of surgery was more definitely realized and the Académie de Chirurgie was founded. The College des Chirurgiens, as this institution was called later, erected a sumptuous, large and well-equipped

building which contrasted strangely with the dismal quarters of the School of Medicine.

But the revolution swept away the decrepit institutions of the old regime. In 1792 the Legislative Assembly abolished corporations and suppressed the schools of medicine and surgery, so that for the next two years no teaching was done. In 1794 the convention decided, on a report drawn up by Fourcroy, to create an "École de Santé," which was installed in the old "College de Chirurgie." This is the location of the present medical school. At this time a library was established, museums for various collections instituted and a clinical service in three hospitals inaugurated. In 1808 the school, which became known as "La Faculté de Médecine," or "College of Medicine," was founded.

At the present time the College of Medicine occupies a site intersected by the rue de l'École de Médecine. Here there is a large building bounded by the Boulevard Saint Germain, the rue Hautefeuille and the rue de l'École de Médecine, containing the amphitheaters and the general offices. The entrance is on the rue de l'École de Médecine through a large courtyard bordered by the colonnade of the old College de Chirurgie. This building also contains a library of more than three hundred thousand volumes and a large museum of comparative anatomy, two laboratories for instruction and research work, the physical and the pharmacological laboratories.

On the other side of the rue de l'École de Médecine, bounded by the rue Antoine Dubois, the rue Monsieur le Prince and the rue Racine, stand the buildings of the École Pratique, or Practical School. In this building are the nine laboratories of anatomy, pathology, bacteriology, chemistry, histology, hygiene, experimental and comparative pathology, general pathology, physiology and therapeutics, as well as amphitheaters and operating rooms. On the ground floor there are also rooms for practical work in anatomy and operative medicine as well as the museum of pathological anatomy known as the Musée Dupuytren.

A new building is under construction which will provide quarters for medical biology and hygiene. The Medical School of Paris also has the privilege of using certain hospital wards belonging to the Assistance Publique and is responsible for the direction of their scientific work. The close coöperation between the School of Medicine and the Assistance Publique is of inestimable advantage to the matriculates of the Medical School. This arrangement also provides practical work in anatomical dissection in the Medical School and in the School of Anatomy (Amphithéâtre d'anatomie des hôpitaux, 17 rue de Fer-a-Moulin), which belongs exclusively to the Assistance Publique.

In addition to these the Medical School has recently drawn up an extensive program for clinical instruction in independent schools, (Enseignement Libre), which the physicians and surgeons of the Paris hospitals may eventually be called upon to direct.

Those of you who have visited France in the years before the war will undoubtedly recall the difficulties you encountered in getting information in regard to medical courses in the various cities. If you were without acquaintances who could furnish you with the necessary introductions to the professors you undoubtedly found it almost, if not quite, impossible to get any opportunity to see the work even when you reached the amphitheater.

If this were true in peace time you may perhaps be able to picture what it was like in February, 1919, when over two thousand American students found themselves in the city of Paris expecting to take courses at the University during the next six months. Of this number 279 were medical men, 32 undergraduates and 247 graduates. Of the undergraduates I do not now propose to say anything, but the thing that will interest this Association is what we were able to do for the graduate students. At this time I received an order from G. H. Q. that "Colonel Samuel Lloyd, M.C., in addition to his other duties, will report for duty at the

Sorbonne University." On presenting this order at the Educational Headquarters I found that no one, including myself, had any idea what my duties were to be, and on presenting a copy of the order to the Rector of the University I found he, too, was in the dark.

In trying to untangle the knot I found that the art and scientific students were being ably taken care of by Professor Bush and Major Coolidge, but nothing was being done for the medical men. I, therefore, immediately turned my attention to that class and found that these men had been aimlessly wandering about Paris trying to find out where they could get work, and that they were so discouraged that the great majority were about ready to ask to be returned to their organizations; nearly one hundred finally gave up in despair.

When I met the dean of the Medical Faculty it was at once evident that the only preparation made to receive this large number of students was a course of lectures to be delivered twice a week by different members of the faculty. There was absolutely no provision for graduate students, and when these students appeared in the lecture, operating rooms and amphitheaters they were rather unceremoniously elbowed out of the points of vantage by the undergraduates for whom the demonstration was intended any way, and who, being expected to pass an examination on the subject, had reason for their insistence on their rights.

In order to bring order out of this chaos it was necessary, first, to secure the registration with the Educational Bureau, and then the matriculation with the University at the Sorbonne of the whole body of students; second; to ascertain what courses the matriculates desired, get them classified and arrange, first, with Sectretariat General at the Sorbonne, then with the dean and secretary of the Medical Faculty and finally with the various professors. As this necessitated constant conferences, it was arranged by the dean of the Medical Faculty that I should have a suite of offices in the

École de Médecine, and this enabled me to get matters arranged much more quickly and systematically. We immediately organized a general conference with all of the students on every Saturday afternoon of each week, appointed monitors for all the classes, received reports from the men, gave notice of new courses arranged and those in contemplation and received and acted upon any complaints.

In a report dated July 7, 1919, I made the following statements: The educational work here in the medical department may be divided into three classes: First, those attending the University and taking postgraduate courses; second, men taking courses preparatory to the study of medicine, most enlisted men and non-commissioned officers; third, classes in reconstructive surgery of the head and face, ordered here by the chief surgeon and not enrolled by or with the Educational Commission or the University of Paris.

The first group, about one hundred and twenty medical officers, were divided into small classes in the branch of medicine which they had practised in civil life. Up to the Easter vacation, the latter part of April, no arrangement had been made by the University to provide for postgraduate instruction, and all of the students in this group found themselves attending lectures and clinics arranged for the regular instruction of the French under-graduates. This was naturally not at all a satisfactory arrangement, as the instruction was elementary in character and the presence of considerable numbers of under-graduates prevented their getting a close observation of the methods of treating patients and operative technic. After a number of conferences with the different professors and of faculty meetings, new courses were arranged providing definite work for these men, and in several instances the schedule arranged was satisfactory.

At the time of my appointment the students had already arrived and had attempted to arrange courses for themselves. They had found it practically impossible to ascertain just what plan of instruction the university expected them to

follow, and a number were so discouraged that they asked to be returned to their organizations or to be allowed to take courses in other schools not connected with the university. It was not until the Easter vacation that we were able to arrange a systematic schedule. In consequence of this the work prior to May 1 was of a desultory character. After that date the work was systematized and every man was obliged to take not less than fifteen hours weekly. The difficulty in arranging post-graduate work was largely due to the methods of instruction in the medical school.

The course in medicine in Paris covers five years and only a comparatively small part of the work is carried on in the medical school itself. The students after finishing the preliminary work of the first two years divide themselves into small groups, taking instruction under the different professors in the various hospitals of the city. Almost all of this practical work is carried on during the same hours of the morning, so that it is impossible for the French medical student to take more than one practical course at a time. Thus at Hotel Dieu, Professor de Lapersonne in ophthalmology, Professor Hartmann in surgery, and Professor Gilbert in medicine have their class work from nine until twelve o'clock daily. This class work includes ward rounds, usually from nine until ten or ten-thirty, then a clinical lecture of an hour's duration, and work in the out-patient department until twelve-thirty or one P.M. The same arrangement applies in the other hospitals. In the afternoon, courses of lectures are given at irregular intervals and laboratory courses are held at the medical school. There are no printed schedules, but the student is left to ascertain from each professor when his lecture will be delivered and what subject he expects to present. The lectures at the medical school are posted on a bulletin board in the hallway and outside of the building.

There are no fixed fees for the tuition in the medical school; fifty francs covers the cost of matriculation and registration, and each professor sets the fee for the course he intends to

give at the beginning of each trimester. The result of this arrangement of conflicting hours and individual fees leads to a certain amount of competition between professors teaching the same branches of medicine and surgery to obtain students. It also leads to the organization of each department as a small medical school with its dispensary clientèle, hospital beds, lecture and operating amphitheaters and laboratories. Obviously, this arrangement made it extremely difficult to arrange courses for postgraduates, so that the matriculate should have an opportunity to study the methods and to obtain as broad a view as possible of the science of medicine as it is taught at the University.

The French professors did not understand at all why our men did not wish in the short time at their disposal to attach themselves to one individual clinic. They had not arranged any courses for graduates in medicine, but expected the American students to be satisfied with the instruction given to the French under-graduates. It was, however, agreed, at a faculty meeting held during Eastern vacation that our students should pursue the courses that appealed to them as offering the best solution of their educational problems. So, many of the men would take one or two hours with Gilbert in medicine, one hour with Marie in neurology, or with Hartmann in surgery, or Legueu in Genito-urinary diseases, or Jeanselme in dermatology.

Gilbert, Chauffard and Widal in medicine, arranged afternoon lectures and laboratory courses; Jeanselme provided for a daily clinic in the mornings in dermatology and syphilis, with practical work and laboratory technic occupying the afternoon; Lapersonne in ophthalmology arranged an excellent course of clinics in the mornings and of laboratory and practical courses in the afternoons; Professors Bezançon, Letuelle and Prenant arranged for lectures in histology, pathology and bacteriology for the under-graduate group of students. It is to be regretted that this course could not have been arranged earlier, as it was admirably conducted and gave

the men very satisfactory under-graduate work. Professor Marie also arranged an excellent course in neuropathology.

At the same time a great many of the men connected with the hospitals, but not with the University, invited our students to avail themselves of their clinics without charge, and in many instances these courses were so practical and so well conducted that I allowed them to be included as University counts. Notably, the course in surgery by Dr. Tuffier was exceptionally popular, and his extreme courtesy, his natural aptitude for teaching and his command of English made his course in surgery most valuable for our students.

The course in hygiene was arranged by Professor Chassevant, who gave a great deal of personal attention to the men, and arranged for them to see the extensive municipal work in sanitation and hygiene of the city of Paris. As this course necessitated travelling long distances in the city and suburbs it was necessary to arrange transportation for the thirty men in the class. This was difficult, as the educational corps did not have transportation available, but by utilizing the transportation of my hospital, and with the coöperation of Colonel Jones, of the Ambulance Service, and of Colonel McAfee, surgeon of the District of Paris, this difficulty was overcome.

A course of lectures was arranged for the medical students by the different members of the faculty and other distinguished members of the medical profession in Paris on the advances of medicine by French investigators. These lectures were all given in French and all were delightful literary productions, but unfortunately the hour at which they were given conflicted with the laboratory and clinical work of the great majority of the students. It was also difficult for the men not proficient in the French language to understand and follow the lecturer. The result was that the number of students attending this course gradually diminished until finally not over ten to twelve appeared. There were only about thirty men in the class who could have

attended without neglecting other important work. An attempt was made to get the hours changed, but this was impossible. I hope that this course of lectures will be published in such a form that it can be placed in the hands of the medical profession.

Looking at the work in retrospect there are two things that have been accomplished: First, giving the opportunity to about one hundred and fifty American medical men to get in close touch with the methods of medical education and scientific investigation in France; second, demonstration to the French savants that American medical men are sufficiently well educated to be admitted to their advanced work and in bringing the faculty to a realization of a necessity of providing for post-graduate instruction in the future. Gradually we were able to arrange for regular graduate teaching. At the first faculty meeting the task seemed so stupendous and the demands of these new students so suddenly thrown on a busy and overworked faculty were so many and varied that they despaired of being able to do the work. We labored together diligently, however, and by combining courses here and reducing our requirements where it was necessary in order to promote harmony we soon had a regular course of post-graduate teaching under way (Easter, 1919), the first *organized* post-graduate medical work in France.

I cannot speak too enthusiastically of the courtesy and help I received throughout the whole six months of my association with the University of Paris, especially from the Rector, M. L. Poincare and the dean of the Medical School, M. Roget. The Pasteur Institute, the Alliance Française and the various laboratories in the medical school and in the University were also unreservedly placed at our disposal and special courses arranged for our students. Unfortunately the School of Military Surgery and Hygiene at Val de Grace was not in operation during these months, as the members of the teaching staff were still on active duty at the front; but Professor Chassevant, of the Department of Hygiene in

the University, took the men who had come for this instruction in hand and gave them a most satisfactory course.

The first and really the greatest difficulty encountered in arranging these courses was the feeling on the part of the faculty that American physicians, even those represented in the army, were not sufficiently well educated to go on with the courses at the University, and they first suggested that all should be examined to see which one of their under-graduate courses our men were fitted to take. This proposition I indignantly declined to entertain and finally brought the discussion to a close by the statement that if this plan were adhered to I should recommend to G. H. Q. that all the graduate students be ordered to rejoin their organizations, as the University was unable to provide adequate facilities for them.

This position was perhaps not surprising when one realizes that in France before taking up the study of medicine students are required to have a bachelor's degree and to have spent at least one year in the study of chemistry, physics and the natural sciences. Very few French medical men of the University have visited America, and they still seemed to think that men could be licensed to practice in our country after simply taking a short correspondence course and without a thorough preliminary education. While this was undoubtedly true years ago it is not true today, and I know that the association of the members of the faculty with this group of students has resulted in establishing a very different feeling.

It was this change undoubtedly that led to my being requested to outline what they should do to establish post-graduate courses that would appeal to our students in the future. In response to this request I forwarded the following letter to the Minister of Public Instruction, to the Rector of the University, and to the Dean of the Medical School: "You asked me some days ago to send you a *resume* of the views that I presented to you in regard to the establishment of post-graduate medical instruction in France. There are

two arguments, it seems to me, that make it necessary for the French authorities to organize at once systematic post-graduate medical courses. First, for many years the vast majority of medical men visiting Europe have been going to Germany and Austria. This migration was necessarily suspended during the war, but there can be little doubt that the German Universities will immediately attempt to reëstablish their prestige and attract the students back to their schools and hospitals. Already, Prague and Italy have established post-graduate schools, but the logical place is Paris: (*a*) Paris is and always has been an attractive place for the Continental visitor. (*b*) Paris has the necessary hospital facilities and a large number of distinguished and talented medical teachers. London at the present time has no systematized scheme of post-graduate instruction for medical men, but a movement in favor of establishing a center of instruction in this city is under consideration.

"For the past thirty-five years the United States have maintained in a number of the different centers thoroughly equipped and organized schools devoting themselves exclusively to the instruction of men who are already graduates in medicine. The largest and best equipped of these institutions in the United States is the New York Post-Graduate Medical School. During the thirty-five years of the existence of this institution it has had more than twenty-seven thousand students, and its yearly average of attendance is between eight hundred and one thousand.

"As a general rule we find that our students are made up of men thirty-five to fifty years of age, and they naturally fall into five groups: First, laboratory, sanitation and hygiene, made up largely of men devoting themselves to research work along the lines of pure science, and health officers and sanitation experts.

"Second, the general practitioner. This class is by far the largest of any of the groups. It is made up generally of men of ten to twenty years' experience whose private

practice requires that they shall know something of all the special subjects included under the general term of medicine, and who in the stress of a busy practitioner of medicine have no time for research and little time for reading the newest books and periodicals. These men want to get a general survey of the whole field of scientific medicine, to see in a short time as much of the new methods of technic and new instruments of precision as possible; to learn new methods of diagnosis and treatment and to observe the use of new drugs. These men require a schedule that enables them to see and hear as many of the teachers as possible in a comparatively short time. As a general rule, we find that the men of this class acquire what we might call the 'post-graduate habit.' They return to the school where they have received the best work for from four to six weeks every year or every second year. They become the progressive men of their respective communities and they know exactly the kind of instruction that they want and will only go to those institutions that can furnish it.

"The third group is made up of men who having several years of general practice find themselves drifting into a speciality and desire to perfect themselves in this particular work. They want intensive training in everything pertaining to the speciality which they expect to adopt. As a rule, they are prepared to spend from six months to a year in study.

"The fourth group comprises the specialists: these men, as a general rule, are already well equipped, and they are travelling about through different large medical centers to compare notes with and watch the technic of the leading men in the different countries.

"Finally, the fifth group, smaller in size but still very important, the men who are already teachers or who have just been appointed to teaching positions. Here we have men of large experience and often brilliant attainments associated with the younger, ambitious and progressive man who has

been selected by his faculty as a candidate for the ultimate succession to a professorship.

"As a natural result of this outline of the class of men who come to our institutions for graduate work it is evident that an organization is essential of men who are willing to give time and thought to the organization of the institutions, who are willing to subordinate individual interests to the success of the school with which they are connected and who appreciate the advantages that will accrue to the profession of medicine by the establishment of institutions devoted to higher learning.

"The question has frequently been asked me how many students such an institution would be likely to have in the course of a year. This will depend to a very large degree on the reputation of the teachers, their willingness to impart knowledge and the facilities they offer to the students for a close observation of their work. In the first year of the New York Post-Graduate Medical School there were but one hundred students. At the present time it would be exceptional not to have from eight hundred to one thousand during any one year. Is there a demand for post-graduate work? is another question I am frequently asked. This question has been definitely answered in the affirmative in the United States, and I believe if France establishes similar courses of instruction that it will be but a short time before the same answer will be given in France.

"Every year a considerable number of the students at the Post-Graduate come to me for advice in regard to where they shall go in Europe to pursue their investigations. In the past I have been sending them to the different clinics in Germany and Austria. I am hoping that in the future it may be possible for me to advise them to come to Paris and that I may be able to place before them a comprehensive scheme, together with definite information in regard to questions of cost and of time required."

Within the past week (December 8, 1920) I have received

the advanced proof of the synopsis of the courses which have now been organized for post-graduate work.

We must pass over the anatomical work offered at the University. This is still purely elementary and intended only for first and second year students. On the other hand good work was provided at Clemart and at the Assistance Publique. Professor Sébileau has also organized a series of classes in practical anatomy which are attracting students already in France, and men are going over from England to take this course. Professor Letulle's course in pathological anatomy is ideal. The work at the University and the Pasteur Institute in bacteriology and histology is very satisfactory, and one can get all the help he may need from the staff at the institute and from Professors Bezançon and Prenant.

Orthopedic Surgery. There are only a few places in France where orthopedic surgery is being practised as a specialty, namely, Paris, Berck-Plage, Strasbourg and Lyon. Broca's work in osteomyelitis and other bone affections at the Hospital for Sick Children is worth following. There are several clinics at Berck-sur-Mer. The Hospital Maritime, belonging to the Assistance Publique of Paris, is an institution of twelve hundred beds which receive from the hospitals in Paris all cases of bone tuberculosis and rickets. The cases are all advanced and there is very little chance for early diagnosis. The hospital is run with a minimum of help, and while the treatment is good there seems to be very little enthusiasm about it and the finer points are not always brought out. Dr. Sorrel the chief is a general surgeon and his assistants are both good men and very patient about explaining things.

There are also other hospitals operated by different private enterprises: Dr. Calot, the Rothschilds, Dr. Cazan and also one by Dr. Calve. All except Dr. Calve's clinic are really sanatoria for the treatment of bone tuberculosis and rickets, and, in general, recumbency, rest and hygiene, with

universally plaster jackets in all Pott's disease cases. Their work, therefore, is quite routine. The operations are simple and secondary.

Dr. Calve's clinic is rather different. He has a hotel clinic with one hundred beds for patients and rooms for their families. The presence of the families being regarded as therapeutic, as it seems to make the patients happier. Dr. Calve and his assistants are scientific and enthusiastic and their work is well done. Plaster work and apparatus are first-class and each case is carefully explained. They spare no trouble in teaching all the details in the treatment. In connection with this there is a large apparatus shop in Paris where the different apparatus is made and where the construction may be seen in detail.

At the Maritime and at Dr. Calve's the operations and visits take place in the forenoon; there is no work in the afternoon. Calot and some of the other hospitals have their visits and operations in the afternoon, so that it is quite possible to be occupied the entire day. A month to six weeks should be sufficient time to devote to this work, as it is given at the present time.

There is an orthopedic hospital at Zuycotte which is a model of its kind, located about twelve miles east of Dunkirk. This is a private charity, built about ten years ago at an expense of thirty-five million francs. At the present time there are sixteen hundred cases in the wards, about nine hundred invalids and the remainder children, who have predisposition to tuberculosis, or are tuberculous, or are of tuberculous parentage, and are sent here for schooling and vacation. This is a most complete and finished plant, but at the present time the work is hampered by the lack of help, both medical and domestic. Cases of bone tuberculosis up to thirty years of age are taken. The Universities of Lyons, Lille and Strasbourg are also offering some very satisfactory courses.

Fees. In Paris the Medical School still maintains the same method with regard to the courses of the different professors that used to be maintained in this country forty or fifty years ago. That is, the student first matriculates at the Sorbonne, paying fifty francs as a matriculation and library fee. He then takes out his tickets for the various courses he desires to pursue at the office of the Medical School. Much confusion is liable to arise if the student does not fully understand the French methods, and he will find by the time that he has finished that he has paid a great deal more money than was necessary. It is extremely difficult to get a readjustment of fees after they are once paid.

The teaching in France is individualistic. Each professor builds up his own organization without reference to the work being done by any one else, and the students attach themselves to one clinic and retain their loyalty to that clinic and its chief throughout their lives. If after graduation they go back to the University for graduate work they do not go to another man's clinic, but always to the one where they had their original training.

This leads to a certain extent to a rather keen competition for students, and the lectures which are marked as gratuitous are really bids for classes. This work amounts to nothing to the true seeker after knowledge; he must pass out of the amphitheater into the working rooms and the wards.

The practical work in all the medical clinics can only be seen by taking the so-called laboratory courses for which fees are charged. The clinics fix their own fees and so one will find that the fees often change with each trimester. If one plans to take different clinics on each day of the week, unless he is very careful and arranges his courses and fees beforehand with each professor, he will find he is being charged the same fee for each course that he would have paid had he devoted all of his time to each one.

For American students this can now be obviated by enrolling with the Collège des États Unis d'Amérique, which

is devoting itself to looking out for the welfare of graduate students in France. The charge for this enrollment is $5. The college will not only arrange for the courses the students desire to follow but will advise him where he can get the work most expeditiously and systematically; will take care of his enrolment, give him the proper introductions, and if he desires it will secure him a place to live in a French family where he can learn the language and see something of the home life of France at the same time he is pursuing his professional work. Dr. E. G. Brackett, 166 Newbury Street, Boston, Mass.; Colonel Harry E. Mock, 1441 People's Gas Building, Chicago, Ill.; and Dr. Samuel Lloyd, 50 East 42d Street, New York City, are the representatives of the College in this country and will be glad to help any men contemplating going abroad for study.

AN APPLIANCE FOR HOLDING INSTRUMENTS GROUPED WHILE OPERATING

By J. W. Henson, M.D.
Richmond, Va.

To those operators who are fortunate enough to have a large and excellently trained operating room staff the device about to be described will not appeal. Such surgeons have only to make signals and have the instrument or whatever they desire presented to hand at once.

In hospitals where there are a number of surgeons on the staff and the rotation makes the continuous service of each very short, or where the individuals composing the operating staff have short terms in the operating room, there is little opportunity for developing a perfectly trained group. Under such conditions, suppose, for example, a hysterectomy is being done. A tableful of instruments is in its proper place, a tray of instruments is extended across the patient's legs convenient to the operator's hand and the instruments are correctly grouped. In spite of this apparent preparedness, several times during the operation the surgeon's eye and hand will be found roving over the instruments, occasionally with the verbal accompaniment, "Where is my knife?" or "Where is my needle-holder?" Which means not only loss of time but embarrassment to the operator.

The writer, having had such experiences, became desperate and determined to find some means to prevent the straying of the essential or the frequently needed instruments. With a piece of soft wire and a pair of pliers with pointed jaws a

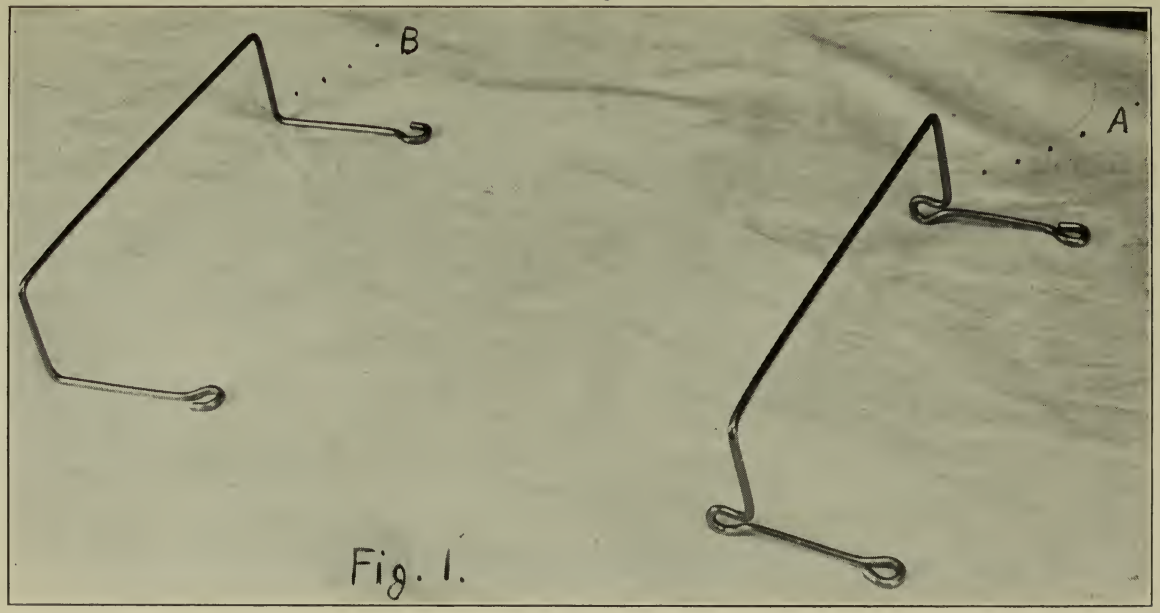


Fig. 1.

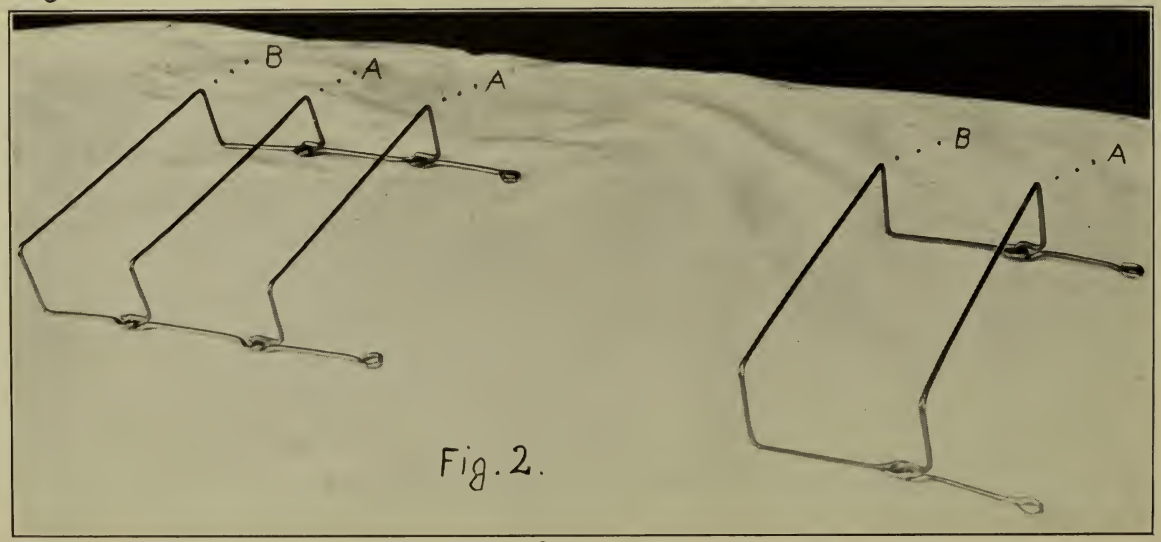
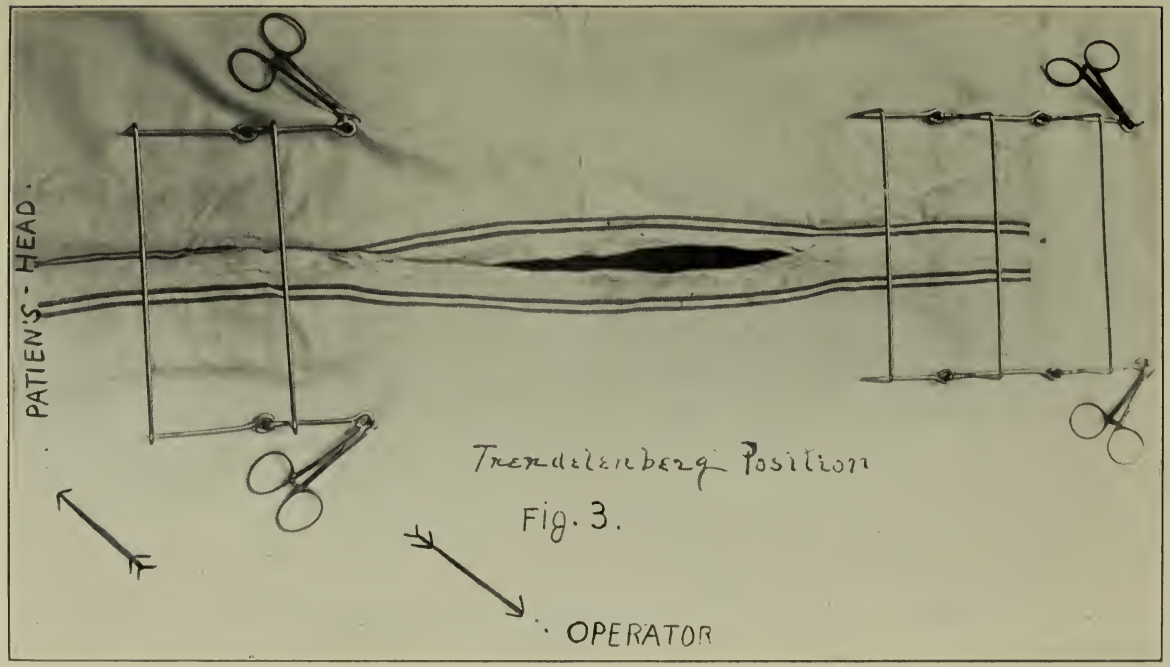
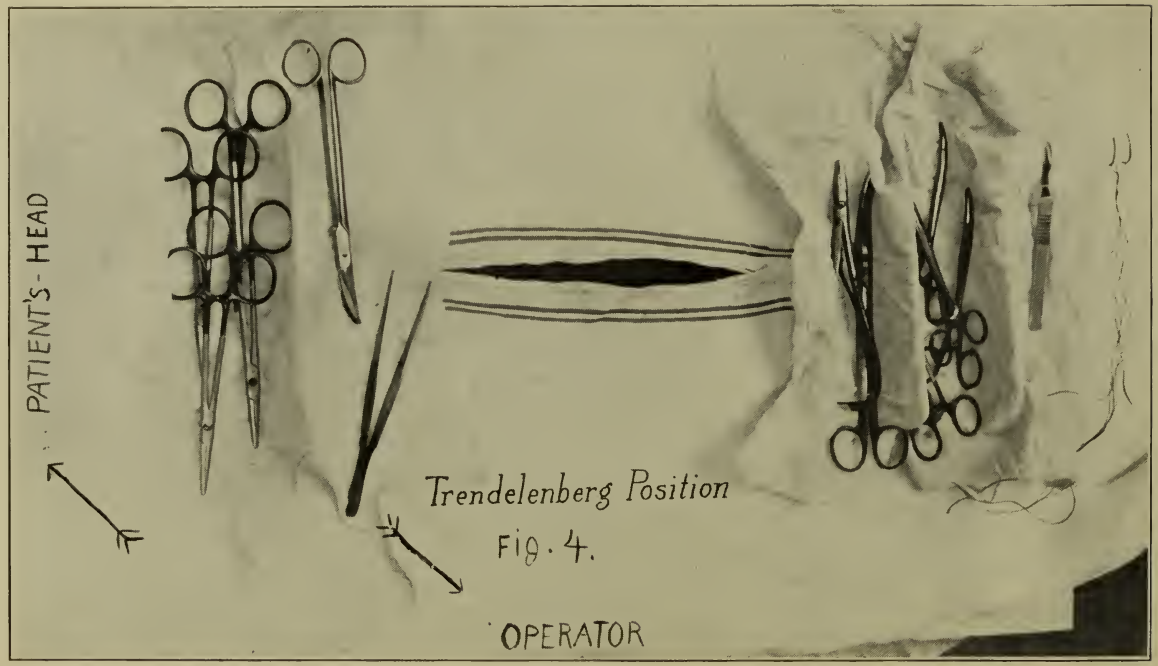


Fig. 2.



Trendelenberg Position

Fig. 3.



Trendelenberg Position

Fig. 4.

model was worked out and turned over to a mechanic. The device is made of iron or steel wire and nickel plated. It is made in sections and so constructed that when two sections fastened together are placed on a plane surface with a wet gauze towel over them there will be two parallel elevations, each about $6\frac{3}{4}$ inches long with a depression between them $3\frac{1}{4}$ inches wide and $1\frac{3}{4}$ inches deep, which will serve as a nest or pocket for a group of instruments. If several sections are united there will be formed a rack which will provide several pockets for groups of instruments.

The sections are made in two types (see *A* and *B*, Fig. 1). For the purpose of description, suppose they are resting on a horizontal surface. The two types have the following features in common, a $6\frac{3}{4}$ inches horizontal bar continuous at each end with a vertical $1\frac{3}{4}$ inches stem, which is in turn continuous at a right angle with a $2\frac{3}{4}$ inches foot-piece, the latter ending in a loop flattened from above downward. The two foot-pieces are parallel, and a vertical plane through each would make a right angle with the horizontal bar. The difference between the two types of sections is that in type *A* each vertical stem at its lower end makes a backward loop before finally continuing into the foot-piece. These loops are flattened from side to side and are for union with the loops on the ends of the foot pieces of another section. Section *B*, being a terminal one, has no loop on its vertical stems.

The writer uses two racks, one made of two sections and the other of three sections. The three-section rack is placed to the right of the operator, the two-section one to the right of the assistant. In operations through a median or near-median abdominal incision the racks are placed with the terminal foot-pieces toward the patient's feet and are fastened to the operating sheet by towel clamps through the loops (Fig. 3). The reason for this particular relation between the racks and the patient's body are that in the Trendelenburg position the weight of the instruments might

cause the racks to fold up if the attached ends were toward the patient's head, and, furthermore, in this position the free or terminal foot-pieces of each rack with the corresponding bar make an additional pocket, as can be seen in Figs. 3 and 4.

The racks are intended to provide for the instruments that are most frequently in demand during an operation. The others are placed on the usual tray with the tray in its usual position. The writer places scissors and needle holder in the first pocket to his right; in the next, hemostats and clamps; and in the third, knives, strands of catgut for ties and needles threaded with the requisite sutures. On the right of the assistant are placed scissors and tissue forceps in the first pocket, and in the second, hemostats and clamps. Note that the tissue forceps, though in the assistant's rack, is placed with the handle toward the operator, for his use and convenient to his left hand.

On account of the sections being joined by a hinge method the racks will fold up and can be conveniently packed in a bag with instruments. The size and shape of the sections comprising the racks and the instruments that comprise the groups in the several pockets are minor considerations. The important ideas are to have fixed places for groups of instruments and to have the groups arranged conveniently, so that the hand of the operator will fall automatically upon the instrument needed. To these two ideas the writer is wedded. As far as this particular appliance is concerned it serves the purpose for which it was devised; but it can easily be altered by any surgeon to conform to his views, and some clever surgeon may work out something that the writer will adopt with pleasure.

FRACTURES OF THE SKULL

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Fractures of the skull are the outward and visible sign of an inward and possibly serious mischief. In reality these fractures do not properly belong to the domain of fractures, but rather to that of neurological surgery. Of recent years much light has been thrown on the incidence of fractures in head injuries by roentgenography, but unfortunately it has not aided much in answering the vital questions involved in the estimation of the extent and degree of brain traumatism. For the solution of these vexing problems we are still dependent on more or less empirical knowledge, and a certain amount of surgical intuition must be our guide in solving them.

Every general surgeon at least will agree that we are as yet a long way from any real and reliable scientific basis for the determination of our conduct in any given case. We operate in this case and abstain in the other, without any degree of certainty as to whether we are acting wisely or contrariwise. There is no doubt but that the future with better coöperation on the part of the surgeon, the neurologist, the ophthalmologist and the clinical pathologist will give us more reliable data upon which to formulate conclusions.

An experience extending over many years and embracing a very large number of observations has left the writer still at sea, and a chartless sea at that. Whose shall be the task to chart this sea and enable us to navigate more safely upon it? Nowhere perhaps in the whole realm of surgery are the

difficulties which beset us more numerous and nowhere will the pursuit of the wrong course be followed by more disastrous consequences. Too great conservatism on the one hand and too great radicalism on the other are equally deplorable.

One of the many difficulties with which we are confronted is the lack of proper organization in the staffs of our hospitals. Too many of our young house men are lacking in the qualifications for scientific study and observation of the cases. Unfortunately they are more interested in assisting in the operating room than in careful study and history-taking in the wards. Until we can impress our young men with the fact that the road to successful surgery begins and should continue in the wards, we shall be deprived of the kind of assistance so necessary to proper diagnosis and treatment. It would seem that the solution of the problem lies in securing men who are paid to devote more time to this work than the busy surgeon engaged in outside practice can or will afford. In a large municipal institution in which almost daily cases of severe head injuries are admitted, it will readily be seen that careful clinical observations made almost hourly are out of the question without some such arrangement, and yet it is upon such careful and accurately recorded observations that so much depends in this class of cases.

The difficulty attendant upon the securing of prompt consultations with the neurological and opthalmological service is almost insurmountable, and yet, as has already been stated, it is only by team work that progress along the lines of more accurate diagnosis can be made. Once the proper conclusions are reached the course of procedure is comparatively simple. A cerebral decompression is within the capabilities of any surgeon possessing the rudiments of surgical technic, and the palliative treatment is too well understood to require detailed description.

Skull injuries may be divided into two primary divisions: Those in which the traumatism to the neural centers is of such severity that the patient is obviously doomed, and dies

within a few hours of the receipt of the injury, and those in which the injury is of such a nature as to permit of the patient living to present those problems of intervention or non-intervention which are to determine the ultimate results of treatment. These problems are obviously those of correctly estimating the amount and character of the brain lesion.

Certain well-known clinical signs are helpful in arriving at our conclusions: The presence or absence of paralysis or spasticity; the presence of brain irritation as shown in the contracted pupil and exaggerated reflexes; the succeeding phase of brain anemia as seen in the dilated pupil and failure to react to light; the evidence of cerebral compression in the increased blood-pressure and increased pressure of the spinal fluid on spinal puncture. All these various phenomena are those by which the surgeon is guided in determining his conduct.

Just how far are we warranted in the assumption that intervention will aid and not diminish the chances of recovery is the problem which we as surgeons are called upon to solve. Obviously, if a patient can be restored to health without a window in his skull and with the possible chance of a hernia of the brain he is better off than one with a cranial defect. It would seem that certain definite rules should guide us in determining when and where not to intervene surgically. Are there such rules; and if so, what are they? In the present state of our ignorance I would say no. The individual equation must enter largely into such a determination. There are those whose habit it is to decompress in practically all cases giving evidence of any degree of compression, their contention being that the patient is thereby spared many of the disabilities arising from brain injury.

With these I am free to confess I am not in accord. Definite symptoms of hemorrhage, as shown by steadily increasing blood-pressure unrelieved by spinal puncture, the presence of depressed fragments of bone or the presence of focal lesions, as shown by paralysis or spasticity, or by convulsive

movements or convulsions, have hitherto been and are still my indications for operation. Up to the present time I have had little reason to depart from this course of conduct.

Fundus examinations should be made, if possible, to determine increasing cerebral compression, but to be of any practical value they must be made by someone thoroughly versed in the use of the ophthalmoscope, and with greater frequency than seems to be practicable.

In this connection I would like to quote the conclusions arrived at by Dr. Martin Cohen from fundus examinations of 75 cases of fractured skull, 24 of which were fatal:

"1. Inequality of pupils combined with bilateral absence of light reflex very common in fatal cases, while comparatively rare in cases that recover.

2. Where there is inequality of pupils with unilateral marked amblyopia or amaurosis in the eye in which the pupil is dilated, one must recognize the possibility subsequently of a resulting descending primary optic atrophy in that eye.

3. Lesions of the fundus are relatively infrequent, especially in cases that recover.

4. Papillitis usually indicates the presence of a meningitis, an increase in the cerebral pressure or a hemorrhage into the sheath of the optic nerve or its immediate vicinity.

5. Contrary to the usual observations, choked disk was not observed in any of these cases of fractured skull.

6. The presence of a unilateral optic atrophy should lead to the investigation of a possible previous head injury if all other causes are excluded.

7. In the cases terminating fatally the pupil was usually dilated on the same side as the corresponding cerebral hemorrhage.

8. Fundus examinations immediately following skull injuries may be helpful from a medico-legal point of view, as it may give evidence of preëxisting contributory factors."

The 41 cases, short excerpts of whose histories are here

presented, represent the head injuries with fracture which have come under my personal care since January 1, 1918. Of these 43 cases, 7 were operated and 36 not operated. Of the 7 operated, 5 recovered and 2 died. Of the 36 not operated, 26 recovered and 10 died. Of the 10 who died, 8 died within two or three hours after admission. The other 2 lived respectively four and five hours, and would have been decompressed had I been called earlier. Of the 2 who died after operation both had severe intradural hemorrhage and 1 had a steadily rising temperature from the time of admission, possibly due to lighting up of old mischief in a formerly diseased mastoid, into which the fracture line ran.

Case I.—J. R., male, black, aged nineteen years. Admitted February 29, 1918. Large scalp wound extending from the upper margin of the right orbit upward and backward toward the median line. Examining finger feels the sharp edge of the frontal bone. Torn dura, small amount of brain substance in wound. Operation, removal of depressed fragment of bone extending into the posterior wall of the frontal sinus. Gauze drainage on account of communication with sinus. Recovery uninterrupted. Discharged well March 25, 1918.

Case II.—W. S., male, white, aged thirty-eight years. Admitted March 4, 1918. Patient unconscious, scalp wound in right parietoöccipital region. Bleeding from right ear. Temperature, 97; pulse, 80; normal tension; pupils equal, react normally. Reflexes normal. Spinal puncture, 15 c.c. of blood-stained fluid. Stereoscopic *x*-ray shows linear fracture in the right parietal bone extending to base. Bleeding from right ear. Recovery uneventful. Discharged March 10, 1918, by request.

Case III.—C. B., male, white, aged thirty-six years. Admitted 4.15 P.M., died 5.45 P.M. Patient in profound

coma, bleeding from nose, mouth and left ear. Pupils equally dilated; do not respond to light. Pulse slow and irregular.

Case IV.—M. Mc.D., female, white, aged six years. Admitted May 9, 1918. Struck by motor car. Patient sluggish but can be aroused. Tenderness and hematoma over the right parietoöccipital region. Temperature and pulse normal. Pupils equal and react to light. Nystagmus toward right side when asleep, absent when awake. Spinal puncture, 20 c.c. of blood-stained fluid. No paralysis. *X*-ray, stereoscope shows linear fracture through occipital to parietal and temporal bones, right side. No depression. Fracture of right femur. Patient discharged well, July 6, 1918, delay due to fractured femur.

Case V.—R. M., female, white, aged thirty-five years. Admitted June 28, 1918. Patient semiconscious; could not answer questions. Scalp wound over left supra-orbital region. Left conjunctiva ecchymosed. Pupils equal, and react to light. No paralysis. Stereoscope. *X*-ray shows a linear fracture about two inches in length in left frontal bone, running into orbital plate of frontal. Discharged improved on request, July 6, 1918.

Case VI.—A. R., adult male, white, aged ———— years. Admitted August 11, 1918. Noisy and excitable, cannot be aroused. Bleeding from nose and both ears. Lacerated wound of right eyebrow. Ecchymosis of right conjunctiva. No palpable signs of injury of scalp. Depressed area above and back of right ear. Evidently old injury. Pupils equal and react to light. Spinal puncture, 12 c.c. of bloody spinal fluid. No paralysis. Recovery uninterrupted. Discharged apparently well, September 5, 1918.

Case VII.—G. M., male, white, aged fifty-four years. Admitted October 6, 1918. Unconscious, breathing stertorous, scalp wound in right parietal region. Pupils contracted. Subconjunctival ecchymosis of right eye. Partial paralysis of left arm and leg. Diagnosis: Fracture of skull. Decompression, subtemporal. Incision at right angle to long diameter of the skull. Large extradural clot. Dura non-pulsating. Crucial incision in dura. Free hemorrhage from within dura. Wound packed with adrenalin-soaked, gauze. Scalp closed over gauze. Patient died October 8, 1918.

Case VIII.—W. McC., male, white, aged forty-eight years. Fell from ladder, over fifteen feet, landing on his head. Admitted October 14, 1918. Patient sluggish but conscious. Hematoma over right parietal region. Pulse slow and full; pupils react to light. Fracture of right patella and olecranon. Decompression. Blood clot over dura. Discharged well November 16, 1918.

Case IX.—J. F., adult male, black, aged ———— years. Admitted October 22, 1918. Scalp wound over left eye. Depressed fracture of frontal bone. Temperature, 97; pulse, 60. No focal symptoms. Patient restless and excited. Shackles applied. Entered 8.15 P.M. Next morning at 8.30 operated, fragments removed and elevated. Non-pulsating dura opened and large subdural clot removed. Gutta-percha drain inserted. Good recovery. Discharged November 20, 1918.

Case X.—D. R., male, white, aged eleven years. Admitted December 19, 1918. Fell off a truck. Suffered contusion of right temporal region. Semiconscious, pupils contracted. Stereoscope. *X*-ray shows horizontal fracture through the right frontal and temporal bones, also shorter oblique fracture in right frontal bone. In thirty-six hours

was fully conscious and continued to improve until his release by request. No paralysis developed. Discharged December 27, 1918.

Case XI.—E. K., female, white, aged twenty-two years. Victim of street-car accident. Admitted unconscious; remained so one hour after admission, January 4, 1919. Then vomiting occurred, followed by two convulsions lasting about five minutes. The convulsions were preceded by twitching of right eyelids and right facial muscles. Profuse hemorrhage from both ears preceded and followed the convulsions. Contusion in right frontal region. Severe headache was present for the first ten days after the accident. Irregular slow pulse from morning of January 7 until evening of January 8. Pain in the ears and buzzing sensation in the top of the head complained of after second week. Taste which disappeared after the accident reappeared January 18. Right facial paralysis appeared January 6, succeeded by left facial paralysis. Stereoscope. *X*-ray showed oblique fracture in left temporal bone running down through the mastoid to petrous portion. Patient improved steadily and was discharged almost well, February 6, 1919.

Case XII.—J. H., male, white, aged fifty-five years. Admitted January 12, 1919. Twelve forty-five p.m. in unconscious state, breathing stertorous. Bleeding from mouth and nose. Alcoholic. Pulse rapid and irregular. Hematoma over left parietal region. No depression. Musculature over body relaxed. No reflexes. Left pupil dilated, right contracted. No response to light. Died 2.10 a.m., January 13, 1919.

Case XIII.—E. F., male, white, aged thirty years. Admitted 11.40 p.m., January 28, 1919. Automobile accident. Patient comatose; hematoma in right frontal region with scalp wound. Large hematoma over right

parietal region. No depression felt. Compound bilateral fracture of madible. Fracture of right maxilla. Pupils equal, dilated; no response to light. Died 1.30 A.M., January 29, 1919.

CASE XIV.—H. F., female, white, aged ten years. Admitted February 1, 1919 in drowsy condition. Temperature, 97; pulse, 100. Scalp wound over right parietal region, no paralysis, no spasticity. Pupils dilated, but react. *X*-ray shows fracture over right parietal bone. Recovery. Discharged February 14, 1919.

CASE XV.—W. H., aged twenty-one years. Admitted February 18, 1919. Was removing dome of ticket booth when it fell striking, him on the head. Was knocked senseless. Does not know when or where he was hurt. Gash over left eye. Eye discolored and almost closed. Bleeding from nose and profuse bleeding from right ear. No paralysis. All reflexes normal. Spinal puncture on account of slow, full pulse, 40 to 50; 20 c.c. of blood-stained spinal fluid. On 22d another spinal puncture; 25 c.c. bloody spinal fluid. Experiences some relief from headache. Steady improvement. Released on request, March 5, 1919.

CASE XVI.—F. B., male, white, aged sixty-two years. Admitted 2 A.M., February 23, 1919. Unconscious, stertorous breathing. Temperature, 95; pulse, 120; respiration 12. Scalp wound over coronal suture on right side. No fracture depression felt. Pupils equal; react to light. Exitus 3.55 A.M., February 23, 1919.

CASE XVII.—J. H., male, white, aged six years. Admitted March 1, 1919. Semiconscious. Abrasion of scalp above right ear over posterior portion of Rolandic area. Large hematoma with depressed center and hard rim such as is felt in hematoma neonatorum. Pupils equal and

react to light. Stereoscope. *X*-ray shows fracture of right parietal bone, beginning in median line and extending downward and forward through temporal bone anterior to external meatus and into base. No depression. Recovery prompt. Released on request in good condition, March 4, 1919.

Case XVIII.—C. G., male, white, aged six years. Admitted March 13, 1919. Conscious. Temperature, 96; pulse, 120. Contusion over the left frontal region above the orbit. Bleeding from nose. Fracture of left tibia and fibula. Stereoscope. *X*-ray shows stellate fracture in left frontal bone just above the orbit. Recovery and discharged April 8, 1919.

Case XIX.—W. F., male, white, aged thirty years. Admitted 11.45 a.m., March 4, 1919. Comatose, odor of alcohol. Bleeding from nose, mouth and both ears. Both eyes closed with extravasated blood. Pulse feeble and irregular. Fracture of vault and base. Died 2.10 p.m., March 4, 1919.

Case XX.—Male, white, aged five years. Admitted April 1, 1919. Fell fifteen feet onto sidewalk, striking on head. Patient unconscious. Pupils equal and react to light. Vomits frequently. Stereoscope. *X*-ray shows distinct line of fracture in left parietal, extending into posterior part of orbit and thence to base. Patient recovered consciousness and progressively improved until released against advice, April 8, 1919.

Case XXI.—J. H., male, white, aged twenty-one years. Admitted 3 p.m., April 13, 1919. Patient comatose, pulse 48, pupils equal and respond to light. Spinal puncture, 30 c.c. bloody spinal fluid, under increased pressure. Pinkish mucous discharge from mouth. Died 8.05 p.m. This

patient should have had a decompression, but I was not called until it was too late.

Case XXII.—G. G., female, white, aged forty years. Admitted 2.30 P.M., April 24, 1919. Struck by car. Depressed fracture of vault of skull and fracture of left femur. Multiple lacerations of arms, body and legs. Pupils equally dilated, do not respond to light. Bleeding from left ear. Pulse not palpable. Died 3.20 P.M., April 24, 1919.

Case XXIII.—E. P., male, white, aged seventeen years. Admitted April 29, 1919. Comatose on admission. Temperature, 99; pulse, 88. Contusion over left parietal bone above the ear. Bleeding from the left ear. Pupils equal, react to light. No ecchymosis in upper or lower lids. No paralysis. Knee-jerks plus. Kernig and Babinski negative. Stereoscope. *X*-ray shows linear fracture of left parietal running down to base and petrous portion of temporal. April 30, 1919, patient recovered from coma. May 3, 1919, developed left-sided facial paralysis. May 15, 1919, paralysis improving. May 21, 1919, patient discharged; paralysis practically disappeared.

Case XXIV.—J. K., male, white, aged forty-seven years. Admitted May 26, 1919. Cut over left eye, two inches in length. Depressed fracture over frontal sinus. No symptoms. No operation advised. Patient discharged, May 28, 1919.

Case XXV.—W. S., male, black, aged seven years. Admitted November 13, 1919. Brought in semiconscious, bleeding from wound back of left ear. Depressed area in supramastoid region. Diagnosis, depressed fracture with probable involvement of lateral sinus. No bleeding from nose, ears or mouth. Eyes shift from side to side. Pupils moderately dilated; react readily to light. Temperature,

97; pulse, 130; respirations shallow and slow. Admitted 4.30 P.M. Heat and saline proctoclysis. Operation 8 P.M. Depressed bone lifted with forceps. On withdrawal of fragment, sharp gush of blood from lateral sinus. Finger introduced feels groove of sigmoid sinus. Bleeding arrested with finger until gauze packing could be inserted. Bleeding stopped and wound closed over packing. Five days later gauze cautiously removed. Renewal of hemorrhage of alarming character. Packing reintroduced. Eight days later gauze partly removed, granulation tissue filling the wound. December 1, more packing removed. December 10, rest of packing removed. Traction on packing causes headache and dizziness. December 12, patient running about the ward in high spirits. Discharged to report to clinic for inspection. Subsequent history, uneventful recovery.

CASE XXVI.—Male, black, aged forty years. Admitted November 6, 1919. Was struck on the head with a shovel. Was unconscious for a time, but came to when brought to the ward. Bleeding from wound in right anterior parietal region. Pulse slow, regular and of good volume. Complete facial paralysis on left side, gradually extending to left hand and arm. Operation, removal of comminuted fragments, one of which penetrated the brain. Small cigarette drain. Wound closed. Discharged November 20, 1919.

CASE XXVII.—W. B., male, white, aged eleven years. Admitted November 18, 1919. Patient entered unconscious, struck by automobile. Several hematomata in the left parietal region. Abrasion of scalp with some bleeding. Breathing quiet and rather shallow. Pulse slow and soft. Pupils react to light. Left rather smaller than right. No paralysis; no spasticity. Eyes roving from side to side. Operation, vertical incision, subtemporal decompression. Fracture line in temporal bone. Dura distended. Non-

pulsating. Dura opened. Gush of blood and cerebrospinal fluid. Wound closed without drainage. Rather stormy convalescence. Discharged well, December 6, 1919. Two months later returned to school.

Case XXVIII.—J. F., male, white, aged seventy years. Admitted November 26, 1919. Patient walked into the receiving ward. Stated he had been struck by an automobile. Was unconscious two hours later when brought to the ward. Has slow bounding pulse, stertorous, breathing, frothing at the mouth. Vomited several times white frothy material. Left pupil much larger than right; neither react to light. There is no bleeding from nose, mouth or ears. Small hematoma in left temporal region. Both arms drawn up in flexion. Right seems more spastic. Both knee-jerks exaggerated. No ankle clonus; no Babinski. Blood-pressure, 160, 100. Spinal tap shows fluid under pressure. Uniformly bloody in both tubes. Three hours after admission signs of compression increasing. Pupils smaller, pulse more rapid and bounding. Respirations slower and more stertorous. Muscular twitchings all over the body. Blood-pressure, 170, 80. Six hours after admission, subtemporal decompression. No fracture discoverable. Dura bulging, non-pulsating. Dura open; gush of blood and cerebrospinal fluid, followed by large clots. More clots removed with Volkman's spoon. Aponeurosis and scalp loosely sutured to permit of further drainage. Patient returned to ward in good condition. Pulse and respiration regular. Spasticity gone. Blood-pressure, 120, 60. Uninterrupted recovery except for dizzy feeling, of which he complains. Released on his own request, January 7, 1920.

Case XXIX.—M. F. D., male, white, aged seventy years. Admitted 2.30 p.m., December 23, 1919. Struck by car. Unconscious; low, muttering delirium. Pulse, 60, irregular; temperature, 97°; pupils equal, dilated, do not react to light.

Bloody projectile vomiting. Bleeding from right ear. Eighth and ninth ribs fractured. Spinal puncture, bloody fluid. Died 3.25 P.M., December 23.

CASE XXX.—C. G., male, white, aged seventy-five years. Admitted 1.50 P.M., December 30, 1919. Struck by car. Fracture of base. Bleeding from mouth, nose, and left ear. Comatose. Pupils equally dilated; no response to light. Temperature 96°; pulse rapid and feeble. Died 2.30 P.M., December 30, 1919.

CASE XXXI.—Male, white, aged thirty years. Admitted 5.30 A.M., March 21, 1920. Comatose, breathing stertorous. Temperature, 96.4°, pulse 64. Depressed fracture over upper left parietal region. Left pupil contracted. Right arm and leg paralyzed. Taken to operating room 10 A.M. Condition so threatening was not operated upon. Returned to ward. Died 12.30 P.M., March 21, 1920.

CASE XXXII.—F. L., male, white, aged fifty-five years. Admitted June 1, 1920. Fell from scaffold, landing on head and left shoulder. Patient unconscious and incoherent. Bleeding from left ear. Left facial paralysis. Stereoscope *X*-ray shows linear fracture in left parietal bone. Fracture of left clavicle and left acromion. Good recovery. Discharged July 6, 1920.

CASE XXXIII.—J. M., male, white, aged thirty-eight years. Admitted June 6, 1920. Unconscious; moans and resists attempts to move him. Temperature 97°; pulse, 98. Bleeding from both ears and nose. Large hematoma on left side of skull, extending down to neck. Left eye swollen shut. No evidence of depressed fracture. Comminuted fracture of left tibia. Spinal puncture, 40 c.c. of bloody spinal fluid under increased pressure. Partially conscious. June 7, 1920, stereoscope. *X*-ray shows stellate fracture in

left temporal region. No depression. Pulse 80, but irregular. June 11, 1920, still irrational. July 2, 1920, spinal puncture; 20 c.c. under pressure. Patient made good recovery. Mentality good. Discharged July 13, 1920.

Case XXXIV.—Male, white, aged thirty years. Admitted June 8, 1920. Thrown from motor-car in collision. Restless and irrational. Extensive scalp wound of right frontoparietal region. Denudation of bone over area of wound. Fissured fracture felt in wound. Fracture of right ulna. Pupils equal, react to light sluggishly. Stereoscope. *X*-ray shows extensive stellate fracture in right parietal bone, radiating upward and downward. No depression. Spinal puncture, 25 c.c. of bloody fluid with normal pressure. Recovery; discharged, August 25, 1920.

Case XXXV.—A. F., male, white, aged forty-four years. Admitted June 18, 1920. Entered walking. Says that on June 1 he was returning from work and was struck on the back of the head. Was unconscious for about fifteen minutes. Since then has been deaf in the left ear, and dizzy, especially when standing. Temperature, 98°; pulse, 86. Pupils equal and react to light and accommodation. Knee reflexes exaggerated. No Babinski, no clonus. Speech more or less stumbling in test phrases. Stereoscope. *X*-ray shows linear fracture in left post-parietal region toward left mastoid. Slight amount of separation. No depression. Rest in bed. Recovery. Discharged July 9, 1920.

Case XXXVI.—Male, white, aged fourteen years. Admitted June 9, 1920. Fall from a height, landing on his head. Unconscious. Bleeding from nose and left ear. Recovered consciousness the following day. No paralysis. Stereoscope. *X*-ray fails to show gross bone lesion. Recovery uninterrupted. Discharged September 21, 1920.

Case XXXVII.—J. B., male, white, aged fifty years. Admitted June 21, 1920. Brought in conscious, but sluggish. Pupils equal and react to light. No paralysis. Reflexes normal. Very deaf; deafness preceded injury many years. Large hematoma over the left temporal region. No evidence of depressed fracture. Stereoscope. *X*-ray shows linear fracture in left parietal region extending downward from the vertex almost to the base of the skull. No depression. Have difficulty in keeping the patient in bed, as he keeps the ward in an uproar of laughter over his constantly reiterated, "Nothing the matter with me, I want to get up." Evidently not right mentally, and referred to the neurological department. Discharged July 26, 1920.

Case XXXVIII.—C. L., male, white, aged sixteen years. Admitted September 25, 1920. Was riding motor-cycle and was struck by motor-car. Suffered severe laceration of perineum, dislocation of left hip and contusion of left side of the skull. Patient conscious. Stereoscope. *X*-ray shows long linear fracture beginning in parietal bone, extending through temporal bone and running into the middle of the frontal and thence to the base of the skull. No depression. In view of extent of fracture, remarkable absence of cerebral symptoms. Good recovery. Discharged November 23, 1920.

Case XXXIX.—E. H., male, white, aged four years. Admitted October 4, 1920. Struck by motor-car. Conscious when picked up. Scalp lacerated over left frontal bone. Bleeding from nose and left ear. *X*-ray shows linear fracture in left area of occipital bone just back of union of occipital and mastoid, running down into occipital fossa. Base of skull probably involved. Patient released on request, in fair condition, October 6, 1920.

Case XL.—J. J., male, black, aged twenty-two years. Admitted October 9, 1920. Conscious, complains of dizziness. Was struck on the top of the head with an iron pipe. There are two scalp wounds over the left parietal near midline. Marked nystagmus when eyes are turned to left side. Facial paralysis on left side, followed by paralysis on right side. Complete facial diplegia. Wassermann positive. Stereoscope. *X*-ray shows linear fracture about one and a half inches in length, extending from about two inches behind and one-half inch above left auditory meatus, back to lambdoidal suture. Diagnosis, traumatic and specific basal meningitis. Salvarsan administered. Referred to neurological service. Patient left the hospital but little improved as to paralysis, to report to out-patient clinic, November 26, 1920.

Case XLI.—O. W., male, white, aged forty-nine years. Admitted October 10, 1920. Complaining of pain in the back and wound in the scalp. Laceration of scalp over left parietal eminence. No depression evident. Pulse small, but of normal frequency. Pupils equal and react to light. No paralysis, nor abnormal reflexes. Stereoscope. *X*-ray shows linear fracture extending from sagittal to lambdoidal suture on left side, about one inch in length. No depression. Recovery uneventful. Discharged October 29, 1920.

Case XLII.—C. D., male, white, aged twenty-seven years. Admitted October 31, 1920. Unconscious, struck by auto. Pulse, 80; temperature, 96°. Pupils equal, contracted. Bleeding from nose and left ear. Stereoscope. *X*-ray shows linear fracture in the left parietal, running into the mastoid. Scar and history of left mastoid operation. Temperature on second day ran to 102°. On third day temperature rising. Left subtemporal decompression done for drainage. Dura pulseless. Opened. Free hemorrhage from neighborhood of lateral sinus. Gauze packing. Continued high temperature rising to 104.6°. Exitus, November 4, 1920.

Case XLIII.—E. M., male, white, aged twenty-eight years. Admitted November 21, 1920. Was driving an auto while intoxicated. Resultant disaster. Patient semi-comatose. Responds to questions irrationally. Pupils equal and respond to light. Several contusions over the right side of the head. Blood in nose and right ear. Pulse regular and full. Fracture of right clavicle. Vomits dark fluid, giving blood reaction. November 25, still irrational. Stereoscope. *X*-ray showed linear fracture of right temporal and parietal bones radiating upward from middle fossa, distinct from grooves of middle meningeal. Also irregular fracture in right parietal. Right facial paralysis. December 1, 1920, facial paralysis complete. December 4, 1920, paralysis much improved. Paralysis disappeared and discharged well December 8, 1920.

THE LATE RESULTS OF A SERIES OF HEAD INJURIES

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This paper is concerned with a study of 52 patients with symptoms of at least twelve months' duration, attributed by the patient in every case to previous injury to the head. The average time intervening between the injury and the period of observation was approximately two and a half years.

A critical analysis of the series was undertaken primarily as part of a study to determine the type of immediate treatment of head injuries which would not only insure a low mortality, but also give the patient the best protection from late complications.

Patients complaining of an old brain injury frequently present no tangible evidence of the lesion which is in most cases as much a cause of real disability as many of the more obvious lesions in other parts of the body. The greatest difficulty in the interpretation of symptoms of these patients as a class arises from the acquisition by them of what appears to be marked functional disturbance, but it is not accurate to classify such patients as neurotics because of inability to demonstrate the underlying cerebral pathology. The frequency with which the syndrome of headache, vertigo, dispositional changes and even epilepsy develops after head injuries may justify the assumption that the injury produced certain organic changes in the brain. It may be that patients

with such pathologic changes more readily develop neuroses and have a heightened susceptibility to the influence of suggestion which in the beneficiaries of compensation laws may be very troublesome.

In the present report 7 patients are eliminated because of a lack of opportunity for detailed study. Certain general observations on this omitted group are included with the discussion of the remaining 45, who were studied under more favorable conditions.

This latter group includes 41 men and 4 women; 37 of the patients had received head injuries such as are common in civil or industrial life, while 7 had been wounded by projectiles during military service.

According to the histories as given by the patients the primary injury varied from a blow without demonstrable fracture of the skull to a destructive lesion of the brain substance itself with loss of extensive areas of scalp and bone. The incidence and duration of primary unconsciousness injuries without demonstrable fracture and those with extensive trauma is practically the same.

The practical classification of Ingham by which the patients are divided into three groups based upon the immediate effects of the injury upon consciousness is adopted.

Group 1. Consciousness retained.

Group 2. Consciousness lost for less than 24 hours.

Group 3. Consciousness lost for more than 24 hours.

This classification while focussing attention upon only one immediate effect of head injuries, is very satisfactory in view of the meager primary observations often made on this type of lesion.

Group 1. There were 8 patients in whom unconsciousness did not follow their injuries. All of these patients complained of symptoms referable to cerebral disturbance and the complaints ranged from major epilepsy to general nervousness. One patient of the group had an extensive penetrating injury of the frontal region with retained foreign bodies, and at the

time of study was having severe headaches and major epilepsy. The remaining 7 patients of the retained consciousness group had injuries in the following regions: 3 parietal, 2 occipital and 2 frontal. In this group although some of the patients were severely injured, the concussion phenomena must have been absent inasmuch as the immediate loss of consciousness from head trauma is usually ascribed to it. The incidence of late symptoms of this group is high, however, as shown by the development of epilepsy in 3, annoying headache in 7, and a residual focal symptom in 1 (hemiparesis).

Group 2. Nineteen patients were unconscious from a few minutes to about twenty-four hours after the injury. In the absence of neurologic data based on a study of these patients at the time of injury it is impossible to assign the causes of unconsciousness in some of them beyond the time when concussion effects should have disappeared. The duration of the effects of concussion alone is not always easy to determine, however, and little is really known of the degree or variety of the cerebral disturbance which concussion may produce. Sixteen of these patients complained of troublesome headache, several had disturbance of memory and changes of disposition and 5 had epilepsy.

Group 3. Eighteen of the patients of the series were unconscious immediately following the injury for more than twenty-four hours. The familiar symptom group of head trauma, vertigo, headache, lapses of memory, inability to concentrate was present in most of these patients, and nine have had epileptic convulsions after the recovery from the early effects of the injury. The prolongation of unconsciousness in this group beyond the twenty-four-hour period, and in some cases for more than two weeks, must have been due to some structural changes in the brain in excess of those usually attributed to concussion. Hemorrhage and cerebral edema were the most probable results of the violence done to the brain tissues in these patients. The unconsciousness

initiated by the concussion was doubtless maintained by the development of edema and compression. In some cases of this group there was destruction of brain tissue by a penetrating missile. Nine, or half of them, had early operations and 5 of the series had cranial defects. Three patients of this group have permanent focal symptoms indicating local brain destruction.

A number of general observations have been made upon the series as a whole. Many of the patients stated that they were unconscious for a few minutes only following the injury, but impairment of memory for varying lengths of time was common and headache and vertigo were almost invariable during convalescence. All of the patients of the three groups came for treatment of disabling symptoms of one kind or another, usually headache, vertigo and other late manifestations of the trauma syndrome. Psychoneurotic complexes and anxiety states were found in only a small percentage of the cases. The symptoms complained of by the patient during the period of observation were found in patients who had received apparently mild as well as severe injuries, and often there were relatively slight late symptoms in patients with extensive injuries.

Those patients with destructive lesions of the brain and permanent focal symptoms showed less general subjective disturbances than many others who had no demonstrable lesion. Twenty-three, or about half of the cases, had a fracture of the skull. Two of the 8 gunshot patients had epilepsy and one other patient with a penetrating injury gave a history of severe general convulsions. Early operations had been done on 15 patients, and of these 3 had epilepsy. The remaining 30 had not been operated upon for the injury, and of these 14 had epilepsy.

Among 4 patients who had primary subtemporal decompression presumably for basal or bursting fracture none had epilepsy. Eleven patients of the series showed an increased and persisting intracranial tension, which was recognized by

blurring of the disks and a definite rise of spinal fluid pressure. Hyperactivity of the deep reflexes was the rule in the series, and it appeared to be true that involvement of the deep reflexes of the upper extremity indicated a greater cerebral disturbance than that of the leg alone.

In attempting to assign a pathological basis for the patients' late disabilities the following early effects may be mentioned; concussion, hemorrhage and edema, destruction of brain tissue, cranial defects and instability of the nervous centers antedating or caused by injury. Naturally there must be a large speculative element in attributing a satisfactory physical basis to conditions which either disturb consciousness or produce late cerebral impairment, and especially is this the case when the lesion affects a silent area, or when gross evidence of structural damage is absent. The problem is simpler when a non-silent area such as the motor cortex, or visual area is involved.

It is interesting to note that nineteen patients of the series were beneficiaries of compensation laws, and in this study an effort has been made to determine the influence of compensation upon the degree or extension of disability. The method of compensation by which the patient receives a weekly allowance during the period of disability, certainly seems to act as a stimulus to the prolongation of disability in those with pretraumatic nervous instability. Such patients may be influenced by relatives or others to believe that all head injuries produce incurable effects, so that the problem often becomes one of great intricacy. In other patients, between the fear of becoming helpless if work is resumed and compensation stops and the certainty of state aid if disability continues, there is created a situation intolerable to the patient. The equation is often met by continued invalidism. This aspect of the subject is one of great economic importance, because the number of compensated cases in industrial life is rapidly increasing. In the series reported several patients gave the impression that compensation was at least a sub-

conscious obstacle to the return to work, but by far the large majority are anxious to resume their occupations and were discouraged by the persistence of disabling symptoms. The results of psychoanalysis of these patients were inconclusive. Similar disturbances were found in the non-compensated cases with injuries at least grossly equivalent. The payment of compensation does not always terminate these traumatic neuroses which have been designated "Conduct Disorders" by Dana and "Compensation Hysteria" by the Germans.

Some point may be given to the discussion of this phase of the subject by a comparison of the compensation statistics of Germany and Denmark prior to the war. In Germany less than 10 per cent. of injured patients with functional nervous disturbance ever returned to work, while in Denmark about 93 per cent. of such patients resumed their occupations.[1] The German compensation laws were similar to our own, while in Denmark the patient receives a prompt and final cash compensation after investigation by a disability board. The Denmark law appears to possess some advantages, provided competent study is made of the patient's disability before the final settlement is made.

It has been interesting to learn from some of the histories that the patient was permanently impressed by the physician's advice as to the necessity of leading a quiet life, free from excesses of all kinds, avoidance of fatigue, the hot sun, tobacco and alcohol. The fact that such a patient has often conducted his life along lines exactly the reverse of those contemplated for his future apparently served to erect a psychoneurotic addition to an organic injury. Briefly stated the advice usually given to and sometimes followed by patients with head injuries may tend to produce the very condition of functional disability which the patient is most anxious to avoid. It appears desirable that advice to recently injured patients as to future living habits be formulated upon a study of the patient as well as the character of the injury.

The incidence of post-traumatic epilepsy is variously estimated. Neuhof[2] in a recent article says that he has had "statements of epilepsy from three patients in a series of 175 head cases observed or operated upon in France." This surprisingly low percentage may be compared with 12.5 per cent. reported by Frazier and Ingham[3] from the Cape May series and 70 per cent. from the reports of Villandre in 1917.

In the small series here reported there were 17 cases, or an incidence of 31 per cent. One observation which may be made on this phase of the subject is at least suggestive. Epilepsy or epileptoid states occurred in 14 patients who received no operation for the injury (47 per cent.). In 15 patients who had early operation there were 3 patients with this diagnosis (20 per cent.). In 4 patients who had had severe injuries and who had decompression operations early, epilepsy has not yet developed, although the injuries were received at least four years before these observations were made.

In two of the non-operated epileptics there were extensive fractures radiating into the sella, and these cases appeared to be benefited by pituitary extract. One epileptic patient had a foreign body removed from the frontal lobe, and cranioplasties were done on two. In one case a negative exploration of the motor cortex was performed on account of suggestive focal symptoms. The present tendency appears to regard surgical operation as having a very limited field of usefulness in the treatment of traumatic epilepsy.

A brief reference will be made to the surgical treatment of the patients of this series. Cranioplasty was performed on six patients for deformity or subjective symptoms. The autogenous cranial transplant was used with satisfactory results in all cases. Subtemporal decompression was performed on three patients who complained chiefly of headache and who showed evidences of intracranial tension in the fundi, and who had a continuing elevation of spinal fluid pressure. These three patients were always relieved temporarily by

lumbar puncture, and this observation suggested the propriety of a permanent decompression. A foreign body (shrapnel) was removed from the frontal lobe of one patient. Indurated painful scars were excised in two cases. Syphilis was a complication in two of the patients. There was no evidence of the influence of focal infections upon their disability in any of these patients, although a routine search was made for the usual foci. Lumbar puncture was done routinely in all cases provided a complete neurological examination did not indicate excessive intracranial tension. A number of patients, with slight elevation of spinal fluid pressure appeared to be considerably benefited by the withdrawal of spinal fluid, and this procedure is to be recommended for relief of the headache and general nervous tension which some of these patients have.

The treatment of old head injuries is difficult because so little is known of the real nature of the primary lesion and the subsequent development of the injury. The study of these old injuries with their crippling disabilities naturally leads back to a consideration of the primary treatment. It is in the early stage of the injury that proper treatment will give the best permanent results. The war experience tends to strengthen the belief that decompression operations are rarely needed for cerebral injuries. In dealing with gunshot wounds the attention of the surgeon was focused primarily on the prevention of infection and the removal of foreign bodies. The question of compression from edema, if requiring special consideration, was by no means of equal importance with that of infection. A study of the methods used with such brilliant results by Cushing and others in the early treatment of head wounds indicates that a decompressive effect was an essential though admittedly a minor result of every intradural operation for the prevention of infection and the removal of foreign bodies and devitalized brain.

There can be no doubt that the thoroughness with which this work was done not only produced an astonishing reduc-

tion of primary mortality and early complications but also diminished the number and severity of late complications. The decompressive effect consequent upon débridement and removal of foreign bodies, although a mere by-product of a larger purpose, may have been a very important factor in offsetting compression from meningocortical hemorrhage and cerebral edema. In the injuries of this series in which no primary operation was performed the late disabilities have appeared to be in excess of those developing in patients who received some form of cerebral decompression.

By analysis of the series reported and the applications of the observations to a parallel series of acute head injuries observed during the same period it has seemed that the study has yielded some results which must be left to a larger number of cases to confirm or contradict. The impressions derived from the study may be included in the following summary:

1. The incidence or severity of the late results of head injuries cannot be predicted upon the type or degree of an acute injury.

2. Epilepsy as a late complication in the series reported has lessened incidence in the cases with early operation. To have value this observation must be substantiated by a larger series.

3. Compensation has a direct influence upon the development of posttraumatic neuroses, but this influence can be determined only by careful neurological study.

4. The prevention of late effects of head injuries is closely linked with the early treatment and after-care.

5. The pathology and evolution of many head injuries of civil life are as yet impossible of demonstration by present methods.

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DISCUSSION ON THE PAPERS OF DRS. CALDWELL AND COLEMAN

Dr. Robert T. Morris, New York City.—Regarding Dr. Coleman's paper, I think he should have placed more emphasis upon objective cause for the subjective symptoms. Incidentally he spoke of psychanalysis. I fear Freud has thrown us back to the middle of the last century, to the days of Schelling and Hahnemann. We may better turn to Virchow, the liberator from mysticism, who showed that an objective cause is to be found for subjective symptoms.

Intracranial pressure in these cases relieved by decompression is commonly due to an irritative lesion and that lesion is often enough due to contraction of dural adhesions. In many of these cases with epileptoid seizures, and the various psychoses coming on as late symptoms of head injury, we overlook this important adhesion factor. In cases in which the dural adhesions cover only a small area we nevertheless may have a very marked demonstration in response even before secondary changes have taken place. If the parenchyma has been injured seriously, if there are fatty changes in the cortex and the cells of Purkinje are destroyed, we are not going to have a good result from the separation of dural adhesions; but where, as is frequently the case, we have simply an irritative lesion of limited area, decompression is not the operation. Separation of dural adhesions and the application of methods for the prevention of their recurrence is the thing. I have used omentum taken from a buttonhole in the patient's abdomen, also Cargile membrane and gold-foil for preventing recurrence.

Dr. Henry O. Marcy, Boston, Mass.—I do not wish to discuss the subject except to relate briefly two cases: One of our soldiers during the Civil War was struck in a cavalry charge by a Confederate officer over the head with a saber who exclaimed, "one Yankee less," and a few minutes later he became unconscious and lay upon the field. Immediately the soldier fired a bullet through the body of the officer who reeled and fell from the saddle. The dead captain and the unconscious private were found lying beside each other. He was subsequently picked up and for five years showed all the symptoms which usually accompany these head injuries, at the end of which time he was operated on. His symptoms were completely relieved by decompression at that late period.

Our friend, Dr. Hunter McGuire, of Richmond, told me of one of the most remarkable cases on record. A man was struck with some missile on the head. He was brought into Richmond unconscious and made a slow recovery. He lost his ability to speak. He lost consciousness as far as thinking and reasoning was concerned and lived an animal life for thirteen years. Dr. McGuire operated on him, and on awakening from the ether the man exclaimed, "Where has the army moved today?"

Dr. W. P. Carr, Washington, D. C.—I should like to emphasize what Dr. Morris has said about adhesions, as I think they are a very important cause of late symptoms following fractures. It has been my custom to deal with the condition by separating the dural adhesions with my finger in some cases, and in others where the adhesions were dense they had to be cut with knife or scissors. In nearly all cases of that kind there has been great improvement. I believe decompression, which is a necessary part of the operation as I do it, has much to do with the recovery. Usually there is an edematous condition of the brain and a great deal of the fluid will drain off during the operation.

I am rather prone to operate on most of the old cases of one or two years' duration, not by subperiosteal decompression but by making a large osteoplastic flap from the temporal region, so that we may expose and examine the whole side of the brain. It has the advantage that it does not leave any permanent defect of the skull because the flap is replaced, and if decompression is necessary it will not go back where it was

before but will jut out a little and enlarge the capacity of the skull considerably. I have had a number of cases in which I could not push the flap back where it belonged without great pressure, and have left it sticking out half an inch. The bone unites readily in four to six weeks and it leaves a permanent increase in the size of the skull. The result of such operations is brilliant in some cases, and nearly always they do good.

In the early cases the thing I am most afraid of is minute lacerations and minute hemorrhages scattered all through the brain. Such cases usually die. When I first commenced to practice surgery we made a very marked distinction between compression and concussion and had our definite rules for deciding whether any particular case was one of compression or concussion. In cases of concussion that die one will always find at autopsy minute lacerations and punctate hemorrhages scattered throughout the brain.

Dr. James E. Thompson, Galveston, Texas.—I wish to discuss Dr. Caldwell's paper because I am particularly interested in the subject. The cases fall into two classes: in one the injury is a severe one and the patient is practically moribund and will probably die within an hour or two. Here no one would dream of interfering in any manner except by spinal puncture. In the other class of cases operation may be considered. The great difficulty hitherto has been to form an accurate estimate as to the exact nature of the brain injury. In other words, to form a mental picture as to the extent of the contusion, laceration and hemorrhage, such as one would see it on the postmortem table. Until we can form an accurate mental picture we shall never be in a position to lay down hard and fast rules as to the justifiability of operation. It must never be forgotten that when we speak of cerebral compression, what we really mean is a group of symptoms that are dependent on intraventricular pressure exerted upon the important centers in the medulla. We do not mean that the cerebral space is filled with blood-clot or that the cortex of the brain is pressed upon by bone, although both these conditions may be present. It is the physiological compression of important centers that is the cause of the symptoms, and this compression is produced in a majority of instances by interference with the flow of cerebrospinal fluid over the cortex of the cerebrum. Whatever we accomplish in the way of operation is done by the relief of pressure in the ventricles. Tempor-

ary improvement can be obtained by tapping the spinal subarachnoid space. If necessary this could be repeated from time to time, or even a permanent drain can be put in. By this means we can carry over serious cases to a satisfactory end. There is very little danger in repeated spinal puncture. The extent of damage to the cortex of the brain is often overestimated. In fatal cases the amount of blood poured onto and into the cerebral cortex is small. Quite frequently a considerable area of the brain is lacerated and we find this area mushed up and mixed with extravasated blood. Massive hemorrhages, except in the case of rupture of the middle meningeal artery, are rare unless the ventricles of the brain are torn open. I am free to admit that I have never been able to lay down any definite set of rules to guide me; each case must be judged on its own merits.

Dr. J. W. Henson, Richmond, Virginia.—If I understood Dr. Morris correctly, in speaking of decompression for the relief of dural adhesions, he referred to postoperative complications sometime after the injury.

Dr. Morris.—Not postoperative only but after almost any skull injury. The patient is hardly aware there has been a brain injury perhaps. Sometimes following a blow or fall there will be practically no cerebral symptoms for a while, but late manifestations may come on after a slight injury, with replacement of exudate by connective tissue and dural adhesions in consequence.

Dr. Henson.—I should like to ask Dr. Morris two questions: First, if there has been any picture taken at the time as to how late manifestations may arise after the injury and how he would locate dural adhesions?

The second question is this: In doing decompression or in making an osteoplastic flap around there will be new fibrous tissue and adhesion to the tissues of the scalp or to the bone flap; and I want to ask Dr. Morris how many cases of late manifestations of brain trouble have followed decompression?

Dr. Morris.—I do not know the proportion. Pictures might show nothing. In regard to the location of adhesions, almost always there is a local tenderness on pressure and the scalp is tender over that point. I remember one case of cyclical

insanity in a girl of eighteen years who was very destructive. She ran about the room, tore down the curtains and did considerable damage generally. It was observed that in the course of her maniacal attack she held one hand to a certain part of the head and would tear down anything in sight with her other hand. The family remembered she had a fall many years before. In her sane intervals I found a point of scalp tenderness, separated dural adhesions, and the girl was completely cured. In many other instances I have found dural adhesions caused sometimes nothing more than headache. If we do not have focal symptoms which allow us to centralize or localize the lesion this point of scalp tenderness above will often suffice for diagnosticating the presence of dural adhesions.

Dr. Coleman (closing the discussion on his part).—I am glad to receive encouragement from the remarks of Dr. Morris and Dr. Carr in reference to dural adhesions. I have been very much discouraged by methods of treating dural adhesions. I feel that at the present time we have no satisfactory method of preventing the formation of adhesions, and I am not sure that we know whether the adhesions are responsible for the patient's disability. There is an impression that the formation of adhesions artificially may prevent epilepsy.

With reference to the localization of a cerebral lesion to a point underlying the area of external tenderness, it would seem that such a method of study would be very unreliable. I have seen quite a number of patients who had had intracranial lesions and who complained chiefly of local tenderness, which was relieved by excision of the dense scar. Such cases are not infrequent as the result of gunshot injuries, and it would seem impossible to say, without excision of the scar, that the pain attributed to dural adhesions might not be due to the cutaneous scar itself. If pain does arise from dural adhesions it might or might not be confined to the area of the adhesions. Radiation of pain in the head lesions is by no means clear in all cases. It is well known that in suboccipital decompressions performed under local anesthesia, patients may complain of supra-orbital pain, although the operative manipulation upon the dura is, as far as possible, from the seat of the pain.

In reference to Dr. Carr's discussion, I may have given the impression that these late disabilities of head injuries are more frequent than is justified by the actual facts. These patients,

fifty-two in number, consulted me during the past year for disabilities attributed to old head injuries. It does not represent by any means the total number of head injuries which have occurred in the community from which the patients came. I have reached no definite conclusions on this point.

In regard to the question of intracranial pressure brought out by Dr. Thompson, I cannot believe from my experience that intraventricular pressure has been the most important factor in the cases of acute injury. It seems to me that we have in these cases a cerebral commotion often followed by secondary edema, which causes not an intraventricular accumulation but a swelling of the brain tissue itself. In puncturing the ventricle in these cases I have usually failed to get fluid. I believe that the multiple punctate hemorrhages spoken of by Dr. Carr are a part of the pathology and an important factor in the production of cerebral edema. This theory was offered by Cannon some years ago. I would not regard these small hemorrhages as necessarily a serious condition, but as a possible feature of all injuries which produce cerebral edema.

Dr. Caldwell (closing the discussion).—I have nothing further to say, except I think it is rather regrettable that we are not able to trace out the subsequent history of many of these peculiar cases. All cases reported in this paper were cases coming into the Cincinnati General Hospital. The private cases I have not reported as they are too isolated in my practice to make it worth while, but I am in hopes with the improved social service we have now in the Cincinnati General Hospital we may follow these cases and at some future time bring before the Association the histories of cases which were discussed with their peculiar manifestations. In two of the cases there was a facial hemorrhage occurring on one side and subsequently the other side was involved. One patient was a colored man in whom we got a positive Wassermann, and I am satisfied the diplegia was a basal meningitis of luetic origin occurring subsequently to the traumatism.

THE PATHOLOGY OF CHRONIC CYSTIC MASTITIS

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Pathology. This paper will describe chiefly the pathology of the various types of chronic cystic mastitis as exposed by an exploratory incision. The more detailed clinical and other studies are reserved for a second paper.

Classification of Chronic Cystic Mastitis. For the present, I have subdivided this lesion of the breast into the following types: single or multiple cysts in chronic cystic mastitis, 210 cases; chronic cystic mastitis without large cysts, 140 cases.

1. The blue-domed cyst. 174 cases.
2. The cyst of the galactocele type. 8 cases.
3. The multiple blue-domed cysts in one or both breasts (diffuse cystic disease of the breast). 28 cases.
4. The non-encapsulated adenomatous area. 48 cases.
5. The non-encapsulated area of chronic cystic mastitis, containing one or more minute cysts or one or more dilated ducts or both. 39 cases.
6. The diffuse dilatation of the ducts, chiefly in the nipple zone, rarely in the breast outside this zone. 22 cases.
7. The non-encapsulated cystic adenoma. 18 cases.
8. The diffuse non-encapsulated cystic adenoma, known in the literature as Schimmelbusch's or Réclus' disease, or senile parenchymatous hypertrophy (Bloodgood). 13 cases.

Pathology in Brief. 1. *The Blue-domed Cyst.* The

characteristic gross feature is a distinct blue dome. This can be recognized if, when cutting down over the tumor, one proceeds slowly, checks hemorrhage, and from time to time moves the knife from side to side. The blue dome in the majority of cases is exposed after dividing the subcutaneous fat. In a certain percentage of cases the cyst is buried in breast tissue, and one must divide a zone of breast before exposing the cyst. Very rarely is the cyst situated behind the breast on the pectoral fascia.

On nicking the cyst wall its color immediately disappears. The cyst wall is as a rule thin (1 mm.); in less than 10 per cent of the cases it has been thicker (2 to 3 mm.). The contents of the cyst has never been hemorrhagic—it is either clear or cloudy; in 4 cases (all from outside surgeons) it has been noted as "brown." In all of my own cases it has been clear or cloudy. The inner wall of the cyst is smooth, without papilloma, and there may be partial partitions or septa.

2. *The Cyst of the Galactocele Type.* This type is less frequent than the blue-domed cyst, as 8 cases is to 174, and differs from the blue-domed cyst in that when its dome is exposed it is white or gray. As a rule the wall is a little thicker. The contents not only resemble milk but coagulate in formalin, while the contents of the blue-domed cyst does not.

3. *Multiple Cysts in One or Both Breasts.* (*Diffuse Cystic Disease of the Breast*). The cysts are of the blue-domed type; a few may be of the galactocele type. The breast or breasts are riddled with cysts of various sizes. The character of the wall and the contents are identical with those of the blue-domed or the cyst of the galactocele type. The frequency of this multiple cystic disease of the breast is as 28 is to 210, or about 13 per cent.

4. *The Non-encapsulated Adenomatous Area.* When this type occurs clinically as a single definite tumor, one must explore to exclude a malignant lesion. Then the palpable tumor will appear as a non-encapsulated area of breast

tissue in which the elevated pink and gray dots representing the adenomatous lobules are more numerous than the surrounding breast. This area resembles somewhat the fibroadenoma, but has less stroma. When this type presents itself clinically as multiple, somewhat indefinite nodules in one or both breasts, each nodule is practically identical in the gross and microscopic picture. I am inclined to the conclusion that, when multiple, the disease corresponds to that described by Warren, of Boston, as the "cobblestone breast," and my recent experience teaches me that operation is not indicated when one can make out multiple, indefinite nodules in both breasts. However, when there is a single definite tumor, it must be explored.

5. *Non-encapsulated Area of Chronic Cystic Mastitis Containing One or More Minute Cysts, or One or More Dilated Ducts, or Both.* When this type appears clinically as a single tumor it must be explored. It differs in the gross from the non-encapsulated adenomatous area only in the presence of one or more minute cysts or one or more dilated ducts; if the latter are present there is apt to be mastitis.

This type may also occur clinically as multiple, indefinite nodules, and corresponds to Warren's "cobblestone breast." Operation is not indicated unless there is a single definite tumor, which must be explored.

It is important to note here that among 140 cases of chronic cystic mastitis 87, or more than 50 per cent, belong to the groups 4 and 5, and in many of these cases the clinical picture was that of the cobblestone breast of Warren, in which operation is not indicated. Many breasts were unnecessarily sacrificed because of the fear of cancer, inability to make a correct clinical diagnosis or to interpret the gross and microscopic picture at the exploratory incision.

6. *Diffuse Dilatation of the Ducts Chiefly in the Nipple Zone, Rarely in the Breast Outside this Zone.* The characteristic clinical picture when the dilated ducts are situated

in the nipple zone is the palpation of a doughy, wormlike mass beneath the nipple. When explored, one can recognize large and small dilated ducts with distinct walls, containing brown, green, milky or cream-like material of various degrees of viscosity and consistency. The contents expresses as soft, wormlike masses, exposing the distinct, smooth wall of the duct—a gross picture, if carefully inspected, different from that of the comedo-adenoma. When it occurs in a zone of breast outside of the nipple area, it feels like diffuse mastitis, but has not the distinct edge or border of the diffuse non-encapsulated cystic adenoma. My recent experience indicates that when one can diagnose this lesion by palpating the wormlike tumor beneath one or both nipples, operation is not indicated.

7. *Non-encapsulated Cystic Adenoma.* This tumor, in the gross, does not differ from the *encapsulated* cystic adenoma. We have 22 examples of the *encapsulated* cystic adenoma and 18 of the *non-encapsulated.* After most careful re-study of all the gross and microscopic specimens I can see practically no difference between the two lesions except the absence of a capsule in the non-encapsulated cystic adenoma, the presence of a little more fibrous tissue, and (one example) the presence of scirrhus carcinoma in combination with the non-encapsulated cystic adenoma.

In the 22 cases of encapsulated cystic adenoma the surgeons removed the tumor only. When sections are submitted to many pathologists the diagnosis of *adenocarcinoma* is frequently made. But there has been no recurrence in any of these 22 cases, notwithstanding the fact that only the tumor had been removed. In contrast, all the 18 cases of group 7, the non-encapsulated cystic adenoma, except one, have ultimately been subjected to the complete operation for cancer. None showed metastasis to the axillary glands; in none has there been recurrence or death from cancer.

8. *Diffuse, Non-encapsulated Cystic Adenoma* (*known in*

the literature as Schimmelbusch's or Reclus's Disease). The characteristic clinical picture in these 13 cases is the palpation of a zone of mastitis in which one can feel many small, shot-like masses. The edge of the involved breast is distinctly palpable. The disease may involve a quadrant, a hemisphere or both breasts. In a few cases it is associated with intermittent retraction of the nipple, and if operation is delayed the retraction becomes permanent.

The clinical picture is so distinct and characteristic that one need not explore. The gross appearance and the microscopic picture are identical with the encapsulated and the non-encapsulated cystic adenoma. In one of the 13 cases there was a gross and microscopic area of cancer. In this instance the clinical and gross picture was malignant and the patient died of metastasis after the complete operation for cancer. This is less than 10 per cent.

Pathology of the Breast Surrounding the Various Types of Chronic Cystic Mastitis. There is nothing in the gross or microscopic pathology of the breast surrounding these different types of palpable tumors which would allow one to distinguish the type of the tumor which leads to operation. These breasts, as a rule, show some evidence of chronic cystic mastitis in the presence of increased adenomatous areas, minute cysts and dilated ducts. The remaining breast tissue now and then is senile. The blue-domed cyst and the diffuse dilatation of the ducts beneath the nipple have been observed in the senile breast more frequently than any other type.

When one cuts out the blue-domed cyst, or the cyst of the galactocele type, or one or more of the multiple blue-domed cysts, or the non-encapsulated adenoma, or the non-encapsulated adenoma with cysts or dilated ducts, or the diffuse dilatation of the ducts, or the non-encapsulated cystic adenoma, or the diffuse non-encapsulated cystic adenoma, one may see almost normal breast on the one hand, or senile breast on the other, or the breast may simply show increased

adenomatous areas or minute cysts and dilated ducts. If the lesion is situated near the nipple, one may expose diffuse dilatation of the duct.

The relative proportion of the various changes in the breast has no practical significance, nor is it of itself an indication for the removal of the breast.

This is a very important observation, because many surgeons, when not influenced to remove the breast by the exposed palpable tumor, have been influenced to remove the breast because of the appearance of the surrounding breast tissue. My conclusions are, that chronic cystic mastitis is not a lesion of the breast which at the present may be considered *precancerous*, and its presence does not demand either the complete excision of the breast or the complete operation for cancer. For the present, in the isolated and diffuse non-encapsulated cystic adenoma, it may be safer to completely remove the breast or do the complete operation for cancer because of the incidence of cancer in 2 out of 31 cases, less than 10 per cent of cancer. One of these cases died of metastasis.

Cancer in the Surrounding Breast. One of my colleagues, in discussing my paper in New Orleans before the Surgical Section of the American Medical Association, expressed the opinion that one must have the entire breast in order to exclude cancer. If this were true there could be no conservative treatment of benign breast lesion and there would be no stimulation for differential diagnosis.

The results of my investigation are as follows: Among the 350 cases of chronic cystic mastitis of the various types here described we have had an opportunity to study the entire breast in 222 cases in which it was removed. In not a single instance have we found *gross* or *microscopic cancer*. The same is true of some 600 benign breast lesions other than those discussed here, among which many breasts were unnecessarily removed, thus allowing complete study of the breast tissue.

Among the 350 cases recorded here as chronic cystic

mastitis, I mentioned two—*the only two*—in which the microscope revealed positive cancer. One of these was an example of a diffuse non-encapsulated cystic adenoma and was clinically malignant, and the area of cancer was picked out *in the gross*. In the other case the area of cancer was recognized in the non-encapsulated cystic adenoma at the exploratory incision.

Therefore, as far as my experience goes with over 900 benign breast lesions, I have no evidence that one needs more than the palpable tumor exposed at operation to make the differential diagnosis. Of course, if one starts to excise what appears to be a benign tumor and finds in cutting through the surrounding breast tissue an area of cancer, one would immediately proceed with the complete operation for cancer. Up to the present I have never had such an experience.

Among some 1200 cases of cancer of the breast we have either recognized the case clinically as malignant and performed the complete operation without exploratory operation, or, when it has been necessary to explore and we have recognized the malignancy from the tumor, the surrounding breast has not been helpful in the differential diagnosis.

Incidence of Cancer in Chronic Cystic Mastitis. First, we must consider how frequently cancer has developed when we have removed the tumor only and left the breast. This has happened among 128 cases on only three occasions. The development of cancer in the breast after the removal of a zone of breast the seat of chronic cystic mastitis is apparently not more frequent than the normal incidence of cancer in the same number of women at the same age who had not been operated on: 3 out of 128 cases—about 2 per cent.[1]

Conservative Operations for the Different Types of Chronic Cystic Mastitis. Of 350 cases the tumor only

[1] Two of these patients died of cancer; both were operated on by outside surgeons. One of my own patients is living (1921), seven years since the complete operation for cancer.

has been excised in 128, or about 37 per cent. I am confident that this is too small a number.

Clinical Diagnosis. The essential feature is the palpation of one or more distinct lumps. The diagnosis rests more upon this than any other data to be obtained from the history or examination.

Age. If the patient is twenty-five years of age or under, this, for practical purposes, almost excludes cancer.

Duration of Tumor. If the tumor has been present two or more years, and has not grown and there is no change in the nipple or skin, the chances are that it is benign; but there are sufficient exceptions to this rule in patients over twenty-five years of age not to justify delay. The lump should be explored: if benign, it should be removed; if malignant, it must be followed at once by the complete operation for cancer.

Multiple Tumors. One distinct tumor in each breast, or more than one tumor in one or both breasts, still clinically benign, practically make the diagnosis of a benign lesion. All the types of chronic cystic mastitis may present the clinical picture of multiple, distinct tumors in one or both breasts. This occurs most frequently with distinct cysts and less frequently in the other types. Benign, encapsulated adenoma of the three types—fibro-adenoma, intracanalicular and cystic adenoma—and lipoma occur as multiple tumors in one or both breasts.

On only two occasions have I observed cancer to begin simultaneously in both breasts. In these two instances the clinical picture was malignant, because the patient had delayed. In a very few cases of malignant tumor there have been two or more palpable masses in the breast. However, in every case one or more of the distinct tumors have been clinically malignant—that is, associated with changes in the skin or retraction of the nipple. Therefore, the palpation of two or more tumors in one or both breasts, still clinically benign, may be looked upon as evidence that they are patho-

logically benign. It might be safer, however, unless one has had a large experience, to explore and remove one of the tumors.

To make the mistake of diagnosing multiple tumors benign, when they are really pathologically malignant, would, from my evidence, not lead to losing an opportunity to save a life. We have never cured a case of cancer in which the tumors were multiple and malignant.

Single Definite Tumor Associated with Multiple Indefinite Nodules or Multiple Shotlike Nodules in One or Both Breasts. This finding, which in my experience is a definite clinical picture, rests upon the most careful palpation of both breasts, a refined sense of touch and experience. This clinical picture does not exclude that the single tumor may be malignant. It indicates that the larger probabilities are that the entire pathological process is benign and due to chronic cystic mastitis. The single definite tumor, unless clinically malignant, should be explored. If clinically malignant, the complete operation for cancer should be performed.

No Definite Tumor in Either Breast, but Multiple Indefinite Nodules or Small Shotlike Nodules in Both Breasts. Among our 350 cases of chronic cystic mastitis, all in the groups 4 and 5, a number of patients have presented this clinical picture and one or both breasts have been unnecessarily removed. I now have records of 44 cases with the identical clinical picture in which I have advised against operation, and these patients followed for fifteen or more years have not developed cancer. This is a larger number than those subjected to operation in groups 4 and 5.

Important Facts in Previous History. If we can obtain a definite history of a disappearing tumor, or of variation in size of the present palpable tumor, this favors the diagnosis of chronic cystic mastitis. Such a history has been obtained in less than 1 per cent of malignant tumors and in more than 15 per cent of well-taken histories of chronic mastitis.

The history of the previous excision of one or more benign

tumors from either breast is evidence indicating that the present tumor is benign, especially if the excised tumor was a blue-domed cyst. Also, when there is a history of excision of one breast for a benign lesion, this favors the diagnosis of benignity in the remaining breast. On the other hand, the history of operation for cancer in one breast favors the diagnosis that the palpable lump in the other breast is malignant.

Single Tumor in One Breast, the Remaining Portion of This and the Other Breast Normal. On the whole, this is the most frequent clinical picture. If there is a definite tumor, and the patient is twenty-five years of age or over, immediate operation is indicated.

Single Tumor, Clinically Malignant. In a few cases the trained sense of palpation may recognize malignancy by touch alone. However, in the majority the diagnosis rests upon retraction or fixation of the nipple, atrophy of the subcutaneous fat, dimpling of the skin, adherent or red skin.

It is true that a certain percentage of benign tumors of all types may give the sensation of malignancy to the palpating finger or be associated with changes in the nipple or skin which usually accompany malignancy. Should the operator perform the complete operation for cancer in all of these benign lesions which present the clinical picture of malignancy the number of women mutilated would be relatively small.

A large experience will be helpful to recognize this benign group and save the patients the mutilation. When the palpable tumor is in the nipple or in the areolar zone, changes in the nipple and skin are less significant of malignancy than when it is situated outside the nipple zone.

Single Tumor Clinically Benign. Now that women are being educated to seek advice the moment they feel a lump in the breast, this clinical picture is becoming more and more frequent, and at the present time we have no method of diagnosis except the palpation of the lump and its exploration.

The number of benign tumors in women over twenty-five years of age, in which it is necessary to remove only the tumor, is too large to justify the removal of the breast or to perform the complete operation for cancer without first ascertaining the pathology of the palpable lump by exploratory incision. I have records of at least 750 benign lesions of the breast in women over twenty-five, of which 350, or almost 50 per cent, belong to the type of chronic cystic mastitis. In the majority of these cases both breasts can be saved, and these women run no more risk of cancer than any other group of women of the same age.

Palpation of the Breast. The educational propaganda is influencing many women to seek immediate advice because of pain or the palpation of a lump in the breast, and I have records of many patients who thought that they had felt a lump, or whose physician had thought he had felt a lump, and who on examination by me had either no lump (61 cases), or the lump was one of many indefinite lumps (44 cases), or was due to simple enlargement of the axillary portion of the breast (24 cases). Here therefore we have 129 women, who sought advice early because of the educational propaganda, whose breasts on careful palpation presented no indication for operation. It is therefore of the greatest importance for all members of the profession who assume the responsibility of diagnosing breast lesions to improve their sense of palpation.

Exploratory Incision. It is my rule always to examine the patient on the day of operation before the area is cleaned, to check up the previous examination and to consider again whether the lump should be explored. The patient is always prepared for the complete operation for cancer and for general anesthesia. The exploration can be made under novocaine or gas. One should have on the instrument table a medicine glass of pure carbolic acid, one of 95 per cent alcohol, and a third of 50 per cent solution of zinc chloride, with swabs.

The incision should be made directly over the lump. The moment the operator exposes the tumor and concludes that it is malignant, the exposed area should be swabbed with pure carbolic followed by alcohol, the wound packed with a piece of gauze saturated with the zinc chloride solution, and closed. Then proceed at once with the complete operation for cancer.

In a few cases the palpable lesion is so small, and the breast so large and fatty, that I have excised a zone in which the palpable lump was situated, packed the wound with an alcohol sponge, and then explored the tumor. Up to the present it has proved to be malignant in only one instance. In this case I burned the wound with the cautery, packed it with zinc chloride gauze, closed it, and proceeded with the cancer operation. This patient is well five years since operation.

When the operator feels that he must have a frozen section, what shall be the method—cut out a piece of the tumor and wait, or cut out a zone of breast about the tumor and wait? I would favor the latter course, that is, to excise the tumor with a good zone of breast and temporarily pack the wound with an alcohol sponge.

Up to the present time, in my own operations, my decision as to the removal of the tumor or the complete operation for cancer has rested upon the gross inspection and palpation of the explored lesion, and I have not waited for the frozen section. Each operator must choose his own method, which should be influenced by the results.

What to Do in Case of Doubt. When one explores a palpable area of the breast and, after gross inspection with or without the aid of an immediate frozen section, is still doubtful as to malignancy, I believe the safer rule is to cauterize the area as described and perform the complete operation for cancer.

The Mistake that Should not be Made. I am confident from the experience of Dr. Halsted's clinic in Johns Hopkins Hos-

pital since 1899, and from my own cases and from the tissues and records sent to me by other surgeons that the mistake of doing an incomplete operation for malignant disease is unnecessary. Cancer of the breast is a distinct gross picture—just as distinct as that in the frozen section—and in this group any surgeon whose experience justifies him in assuming the responsibility for the operation, should and, as far as my records go, does recognize distinct cancer and performs the complete operation.

The Mistake that is Made and which Produces No Harm but Mutilation is the complete operation for benign lesions of the breast, especially for chronic cystic mastitis. This is due to the fact that the relation of chronic cystic mastitis to cancer has been exaggerated in the literature. It is also due to the fact that pathologists disagree as to the histological picture of the zone of breast about the cyst and of the groups 4 to 8. Some of these non-encapsulated lesions closely resemble cancer.

Until, therefore, we have established a method of differential diagnosis, the mistake of occasionally performing the complete operation for cancer for doubtful benign lesions is unavoidable. Among our 350 cases of chronic cystic mastitis, in 210—almost two-thirds—the lesion was a distinct cyst, either with a blue dome or one of the galactocele type. I hope that my description will be helpful to operators and pathologists to recognize this type and at least save two-thirds of the patients with chronic cystic mastitis from the unnecessary removal of one or both breasts. The complete paper and illustrations will be published in the Archives of Surgery.

THE CONTROL OF CANCER

By Charles A. Powers, M.D.
President of the American Society for the Control of Cancer.

(By invitation)

My first and very pleasant duty is to thank the officers of this Association for the kind invitation to address you. It is a compliment to the national society which I represent, and in choosing a title I have felt that the simple one appearing on your program may warrant the iteration of homely truths already well known to you as well as the setting forth of thoughts which I cherish for the further waging of a vigorous campaign against one of the most dreaded and dreadful scourges which afflict mankind. It is, indeed, with the hope of enlisting the active aid of every member of this important body of surgeons that I venture to lay stress on certain avenues of attack which at this time seem to promise progressive diminution of cancer mortality and suffering.

History of the Society. Inception of the formation of the society found place in the American Gynecological Association, delegates from which met in May, 1913, with delegates from the American Surgical Association, the American Medical Association and other representative national bodies, to found a national organization. "To disseminate knowledge concerning the symptoms, diagnosis, treatment and prevention of cancer, to investigate the conditions under which cancer is found and to compile statistics in regard thereto."

In establishing an organization with this purpose the

founders gave practical expression to their hope and belief that a nation-wide campaign of public education regarding cancer would save thousands of lives now needlessly sacrificed every year because of ignorance of the warning signs of this insidious disease and delay in seeking competent medical advice and treatment even after the symptoms are recognized.

In the latter part of 1913 and in 1914 a certain amount of preliminary work was done, especially in Massachusetts, thanks to the sustained interest of Dr. Edward Reynolds. Literature (to which later reference will be made) was carefully prepared for both the profession and the laity. Then came the Great War, with its attendant responsibilities, anxieties and duties, and the work of the society naturally languished. During the past year, however, state and local organization has been effected, and, to paraphrase a war phrase, "The decks have been cleared and the society is ready to get into action."

Immediate Aims of the Society. Greenough,[1] in an illuminating address read before the Medical Society of the County of New York, says that in the cancer problem four lines of attack present themselves for consideration:

1. The education of the public to the early symptoms of the disease.

2. The instruction of the medical profession as to the actual facts of this serious situation to bring about earlier diagnosis.

3. The promotion of investigations on the part of surgeons in regard to more effective means of operative treatment.

4. The promotion of investigations in the laboratory in regard to the causes of cancer and of methods of treatment other than by operation.

I take it that at this time the Cancer Society may well occupy itself with the first two of these contentions: to effect the widest possible diffusion of knowledge among the laity regarding the early symptoms of cancer and at the same time

[1] New York Medical Journal, October 16, 1920.

to aid in bringing the members of our profession to a clearer and higher conception of their own duties and responsibilities. The two endeavors go hand in hand. We know that at this time an average period of ten months elapses between the discovery by the given man or woman of the first symptoms of cancer and the seeking of medical advice. It is our aim to reduce this period as nearly as possible to one day. Further, we are to endeavor to aid the given practitioner in acquiring the ability to make a thorough, suitable examination and to give adequate advice.

There is not one of us who fails to understand the natural desire for concealment on the part of a given patient. Only too often is cancer considered a disgrace. It is in no way a disgrace; it is only one of the most terrible of misfortunes. There seems to be no suitable substitute word for the word "cancer." I feel that one of our important duties consists in familiarizing the people with this word, in teaching them that the condition is not a blood disease, that it is not contagious and that it cannot be communicated by one person to another. It is certain that constant effort toward familiarization with the word itself will slowly and steadily tend to rob the word of a part, at any rate, of its terrors. It is already found that in communities in which a considerable number of suitable talks[1] have been carefully made, people tend more and more toward open discussion of the condition. The whole subject should be brought out into the light.

Organization. The American Society for the Control of Cancer maintains a central office at No. 25 West 45th Street, New York, this office being under the care of a lay executive secretary, Mr. Frank J. Osborne, who is a trained public health worker. During the past year a thorough regional and state organization has been effected, and it may not be amiss to give a table of this. In certain areas regional direc-

[1] In Colorado, where a goodly number of these talks have been given, an increasing desire to hear them is manifest.

tors have been appointed, each director looking after a given group of states, appointing state chairmen, subcommittees and the like, and effecting a general organization of the work. Thus the New England states with the exception of Connecticut are under the care of Dr. Robert B. Greenough, of Boston; Dr. J. C. Bloodgood, of Baltimore, looks after Maryland, Virginia and Delaware; Dr. Fred T. Murphy, of Detroit, takes charge of Michigan, Ohio, Wisconsin and Illinois; Dr. C. Jeff Miller, of New Orleans, looks after Louisiana, Mississippi and Alabama; Dr. Donald C. Balfour, temporarily a resident of Denver, takes Colorado, Arizona, New Mexico, Utah, Wyoming and Western Kansas; Dr. F. J. Taussig, of St. Louis, Missouri, Oklahoma, Arkansas and Eastern Kansas; Dr. Verne C. Hunt, of Rochester, Minnesota, has Minnesota, Iowa, North and South Dakota and Montana; Dr. H. M. Sherman, of San Francisco, takes California and Nevada, while Dr. E. F. Tucker, of Portland, Oregon, has charge of Oregon, Washington and Idaho.

State Chairmen are as follows: Connecticut, Dr. Joseph M. Flint, of New Haven; West Virginia, Dr. F. L. Hupp, of Wheeling; North Carolina, Dr. J. W. Long, of Greensboro; South Carolina, Dr. R. S. Cathcart, of Charleston; Georgia, Dr. G. R. White, of Savannah; Florida, Dr. Ralph N. Greene, of Jacksonville; Kentucky, Dr. I. Lindenberger, of Louisville; Tennessee, Dr. W. D. Haggard, of Nashville; Indiana, Dr. Miles F. Porter, of Fort Wayne; District of Columbia, Dr. James F. Mitchell, of Washington; Nebraska, Dr. Palmer Findley, of Omaha; Texas, Dr. A. C. Scott, of Temple; New Mexico, Dr. James A. Rolls, of Sante Fé; Washington, Dr. C. W. Sharples, of Seattle; Idaho, Dr. L. P. McCalla, of Boisé; Wisconsin, Dr. John L. Yates, of Milwaukee; Illinois, Dr. Carl B. Davis, of Chicago; Ohio, Dr. J. L. Ransohoff, of Cincinnati; Michigan, Dr. Reuben Peterson, of Ann Arbor; Arkansas, Dr. Dewell Gann, of Little Rock; Colorado, Dr. F. W. Kenney, of Denver. Hawaii is in charge of Dr. James R. Judd, of Honolulu.

That the society is fortunate in having the active aid and support of these men[1] goes without saying. Their names furnish ample guaranty that the work is being done carefully, conservatively, thoroughly and efficiently.

The Relation of the Cancer Society to the Medical Profession. Under the very competent chairmanship of Dr. Greenough, of Boston, a committee of the society has prepared a hand-book for the profession, and it is our endeavor to have this distributed as widely as possible. This distribution can be effected through the agency of state medical societies, state boards of health, etc. Having had but little share in the preparation of the various forms of the literature which our society puts forth, I can, perhaps, gracefully speak of the conservative excellence of these publications. Certainly, I do not believe that any of our experienced surgeons can fail to derive pleasure and profit from reading this little professional brochure as well as from the lay pamphlets.

Sessions of our state and county medical societies, special national societies, the various sections of the American Medical Association, etc., may well be devoted with increasing frequency to this most important subject. At all of these meetings the importance of suitable lay education may with propriety be emphasized, and we may well aid in arranging cancer meetings for the dental societies. The dentist is not infrequently the first to observe the appearance of mouth cancer; he is naturally anxious to know the early symptoms.

The Instruction of Nurses. This is most important. The Cancer Society has prepared a special pamphlet for nurses, and this should receive the widest possible distribution. Special talks on the early recognition of cancer should be made before the various associations of graduate nurses

[1] On the Executive Committee, which meets monthly in New York, under the Chairmanship of Dr. Howard C. Taylor, are men of the fine type of Cleveland, Lillienthal, F. C. Wood, Ewing and F. K. Hoffmann.

as well as before the nurses who are taking their hospital training.

THE EDUCATION OF THE LAITY. Certainly no activity in the domain of cancer can be more important than this, and I am convinced that the most valuable way of instructing the people in the simple facts connected with cancer lies in the giving of well-considered talks of groups[1] of varying size. In these talks assurance of plain, leading facts can be given. The audience may be told that cancer is not hereditary, that it is not contagious, that it is not a blood disease, that it is at first local. The statement can truthfully be made that in very many regions it is curable when taken early. Simple, plain, non-technical description may be given of the early symptoms and signs in such regions as the breast, the uterus, the skin in its various portions, the lip, etc. These are very simple matters to us, but it is astonishing how ignorant the lay people are of the plain facts which they should know. Speakers universally report an earnest desire on the part of their hearers to learn these facts; approaching a group of people in a spirit of broad, human sympathy, it is pathetic to note the eagerness with which they listen.

[1] In Denver during the last year many cancer talks have been made before such bodies as: the Woman's Club, Department Store Employées the Knights of Columbus, the Elks, the Colorado Educational Association, the Association of State Librarians, the State Congress of Social Workers, Women's Aid Societies of various churches (Protestant, Roman Catholic and Jewish), the Y.M.C.A. and the Y.W.C.A., the Association of Collegiate Alumnæ, the Protestant Ministers' Alliance, the Junior League, the Employées of the Telephone Company and of the Tramway Company, the Garment Workers' Union, the Parent Teachers' Associations, etc. In addition, articles have been read before the Colorado State Medical Society and the Denver County Medical Society. . . Colorado Springs, Colorado, is a town of 25,000 people. It is both interesting and gratifying to note that during the month of October, 1920, Dr. Charles F. Gardiner, the chairman of our Cancer Committee there, made with the assistance of members of his committee, no less than thirty cancer talks to lay groups of varying size, largely groups of women. Such a task is accomplished in a personal way; one can but wish that in every town similar work might be done.

The society has very carefully prepared pamphlets for distribution at these lay meetings, and it also has illustrative lantern slides which materially aid in pointing the moral and adorning the tale. It is our experience that these talks should be brief. A well-equipped speaker can say a great deal in fifteen minutes.[1] A few leading points[2] can be made with clarity, and the little pamphlets which the auditors take home with them will serve to recall these facts and emphasize them. We all know that women are much more interested listeners than are men when it comes to the consideration of this particular subject. Visiting and public health nurses can distribute our pamphlets and by simple instruction spread the gospel. We endeavor to have a succession of suitably written articles in such lay periodicals as the *Outlook*, *Independent*, *Woman's Home Journal*, *Saturday Evening Post*, etc.

PUBLICITY. This is the keynote to our campaign; it is the crux of our problem. One need say but little regarding the instruction of the members of our own profession. Our society simply desires to aid in every possible way by the distribution of helpful hand-books, by urging[3] suitable meetings which are wholly or in part devoted to this subject—meetings of national, state or local medical societies. At

[1] A twelve or fifteen minute talk can often be interpolated in the course of the regular program of the annual meeting of such societies as the Federation of Women's Clubs, State Federation of School Teachers, Social Welfare Organizations, State Association of Librarians, etc.

[2] The question is often asked whether such a campaign as is outlined here does not tend to create undue fear—"phobia," so to speak, in the minds of the people who hear the lectures and read the articles. I am certain that no harm is done in this way; it is better that a few people should be unduly disturbed than that a single case of beginning cancer should be neglected. Our intelligent medical profession can easily set people aright.

[3] The aid of all existing agencies is earnestly asked. Medical societies, state and local Boards of Health, the Red Cross and similar organizations can constantly help. It is gratifying to note that the American College of Surgeons is laying stress on cancer education in its meetings held in various parts of our country.

these medical meetings emphasis may properly be laid on the great importance of constant instruction[1] given the laity.

As we approach the instruction of the laity we find many avenues[2] open to us: Carefully given talks to groups of men or women or of both as has been previously outlined; distribution of the society's pamphlets at these meetings; notice given of these meetings in every possible way, including the daily press.

In this matter of notices, reading articles and the like in the daily press, I hope that you will bear with me when I say that I believe that we, as a profession, have, in large part, leaned backward in our effort to avoid publicity. Our aim is to get our message (let us call this a "Message of Hope," if you will) before the people, and this must be done in a very authoritative way. At times the name of the American Society for the Control of Cancer or of a given state or county medical society or other organization may suffice. More often does the public desire to know the name or names of one or more well-known physicians or surgeons who make themselves responsible for what is said. We all know, we all respect, the splendid ethics of our profession, and I think that we support the ethics when we, in a suitable way, lay aside our personal prejudices and desires.[3] I grant you that it is easier to be a philosopher at sixty-odd than it was at twenty-odd or thirty-odd or even at the steady age of forty-odd. Further, one's point of view may be changed very materially after he has retired from active practice. And yet, in this so very important matter, I know that you will feel with me that our duty to humanity is paramount.

[1] Dr. T. W. Huntington, of San Francisco, is giving splendid aid in the matter of articles sent medical journals, etc.

[2] Cancer "days" and "weeks" have been successfully held by Dr. Wainwright, of Scranton, Pa., and by others.

[3] I know that I shall be understood in this—I mean that we should not withhold clear, direct statements which are made solely for the public good.

The universally distributed motion-picture houses of today are capable of furnishing wonderfully effective publicity. In preparing for a recent cancer campaign in Denver we were fortunate in being able to have the following notice set forth during periods of from two to seven days in eight of the principal downtown motion-picture theaters:

"CANCER. The American Society for the Control of Cancer says:

"1. That 85,000 people die yearly in the United States from this dread disease.

"2. That the majority of these deaths could be avoided if the condition were taken early.

"3. That in early recognition lies the hope of cure. Cancer campaign in Denver next week! Watch the newspapers for notices!"

It was conservatively estimated that the foregoing notice was seen by at least 100,000 people. The effectiveness of such publicity is apparent. The Cancer Society has at this time in preparation two instructive motion-picture plays—one for the profession and one for the laity. It is hoped that these may be produced in the immediate future.

In further connection with this matter of publicity I should like to say to you that one of the most distinguished members of this Association, a surgeon who has long been a pioneer in the war against cancer, Dr. Joseph C. Bloodgood, has for some years enclosed with letters, etc., to former patients and their physicians, a carefully worded circular letter of cancer information. This is certainly one of the best possible ways of carrying on our campaign; one can but think of the wonderful good which would be done if every physician and surgeon should adopt this plan. In a recent letter Dr. Bloodgood says: "I think I have the evidence to show that I have done more good by teaching the public and the medical and nursing professions than by the operative treatment of cancer." Would that each one of us were able to say this!

Mention has been made of carefully prepared articles

published in the more important lay papers and magazines. I have already trespassed on your patience and will refer but briefly to such matters as the quack advertisements in newspapers, magazines, etc., which our society, through its officers and committees, is endeavoring to have abolished; to the important matter of the employment of radium and the x-rays in the treatment of cancer, which our society looks upon with deep, conservative interest; to the splendid research work which is going on in such responsible institutions as the Crocker Institute for Cancer Research of Columbia University, the Harvard Commission for Cancer Investigation, the General Memorial Hospital of New York, the Skin and Cancer Hospital of St. Louis, the New York State Laboratory of Malignant Disease at Buffalo, and the other splendid foundations both here and abroad. In the fulness of time a specific for the prevention or cure of this terrible disease will be found. Even then, however, education will have its place, and in the meantime education holds a first place. And it is in this thought that I confidently ask each of you, in his given community, to become an active educational agent.

CANCER INFECTION

By Albert J. Ochsner, M.D.
Chicago, Ill.

As far back as medical history extends there have been certain diseases which have been looked upon and feared by the public because they have been supposed to be transmissible from one person to others in some way. Their mode of transmission has been explained in many cases since their etiology has been determined by finding certain microorganisms which could be isolated, grown upon culture media, and which when inoculated upon healthy animals or upon human beings produced the identical disease from which the patient suffered from whom the original microörganisms were taken.

In this manner diseases which had for centuries been looked upon as contagious or infectious were definitely proved to be so. Other diseases, like measles, scarlatina and smallpox, in which it has not been possible to isolate the specific microörganisms, are so evidently due to infection that no one is in doubt about this fact. For many years the public consciousness, often called superstition, has recognized the infectiousness of tuberculosis, leprosy and cancer, while many of the most learned members of the medical profession have claimed the contrary because the infectious character has not been demonstrated on account of technical difficulties. These have fortunately been cleared away in the case of tuberculosis and leprosy, but not as yet, at least, so far as general knowledge is concerned, in the case of cancer.

Had Robert Koch or some other investigator not demon-

strated the tubercle bacillus there is no doubt but what hundreds of thousands of healthy persons who are now protected against tuberculous infection would still be exposed to this danger precisely as they are exposed to the danger of infection from cancer today. This is due to a simple error in logic. We disregard the popular prejudice because we cannot demonstrate a scientific basis for this prejudice, instead of accepting the popular prejudice as being in all probability based upon observation and knowledge which was lost during the dark ages which was well founded upon fact during the ages which preceded this period of ignorance. We say, because we cannot find the agent of infection, therefore, it does not exist, instead of saying our ignorance, incompetence and lack of skill and insight have prevented us up to the present time from discovering this agent; hence we must approach the question always from a new angle until we will ultimately succeed in establishing conditions which will enable us to determine this cause.

We may say that the appearance of cancer is preceded so constantly by long-continued local irritation as in smokers' cancer, the cancer of betel-nut chewers, that of paraffin-workers, chimney-sweeps, etc.; hence we are justified in considering this irritation as the actual cause. What would we think of a farmer who would fail to put seed on his land because he has observed that the soil has to have a certain degree of preparation before a certain crop can grow?

In the same way we have observed that cancer will develop very constantly on the proximal side of the pylorus and on the distal side of the ileocecal valve, while it will develop only rarely between these two points. The fields in which it will develop contain substances acid in reaction while the intestinal contents in the intervening portion is alkaline. The farmer knows that he can grow rye in an acid soil, but in order to produce a growth of alfalfa or red clover the soil must be alkaline. In either case, however, he must sow the specific seed which will produce the growth desired.

We know that it is an easy matter to transplant carcinoma nodules from one animal to another, but that if these nodules are exposed to a temperature of 160° F. that no growth will occur. This may mean that the tissue itself cannot live in a temperature higher than this; or it may mean that this is the limit for the life of the infectious material causing the cancer. For many years the fact that the few experiments in transplanting human cancer from one person to another have failed has been looked upon as proof for the non-transmissibility of cancer from person to person. Of course, this has been long disproved by animal experimentation, but it serves as an example of the harm that can be done by concluding that because one has failed to prove a fact, therefore it has been disproved, or because one has not been able to do it, therefore it cannot be done.

For years the failure of attempts to transplant cancer or to inoculate cancer from one person to another was used as an argument against the infectiousness of cancer. This would not be of much importance were it not for the fact that in the meantime, while we are waiting for some person who is competent to discover the cause of infection, the public is encouraged in exposing themselves to this infection against which popular prejudice might otherwise protect these persons.

A study of the literature shows that less than thirty years ago Langstaff[1] and many others proved statistically and to their minds scientifically that tuberculosis is not infectious or contagious because in many families the husband or wife suffered and in many instances died from the disease, the other partner remaining free from it. This identical argument is being advanced in the case of cancer. The fact that the soil must be proper, as well as the seed, in order to secure growth is being overlooked in the case of cancer as it has in every disease which has been classed as infectious or contagious by popular belief or prejudice.

[1] Studies in Statistics, London, 1891.

The experiment of Miss Slye with white mice shows conclusively that certain animals are more susceptible to the development of cancer, because of heredity, than others. The fact that whole families of human beings have died of cancer has been used as an argument in favor of infection because living together they are all likely to be exposed to the same sources of infection. The same has been claimed for houses in which successive families have died from cancer. On the other hand these conditions have been ascribed to coincidence or to hereditary tendency. The fact that surgeons do not generally die of cancer has been given as an argument against infection. If one observes the care with which surgeons guard against possible infection of any kind this argument at once loses all weight.

The fact that we find the same histological structure of metastatic cancer that we find in the primary growth has been used to discredit the infectious theory. Metastases must consequently be transplanted particles of tumor tissue and not infections at a distance from the original growth. If the cause of cancer is an infection, apparently it sets free living cells, some of which will continue to grow after being carried to a distance by the lymph stream or the blood stream. There seems to be an exception in case of Paget's disease of the breast, in which one may find squamous epithelium in the original cancer about the nipple, columnar epithelium in the secondary cancer along the milk duct, and glandular cancer in the mammary gland, while there may be metastases in the axillary lymph nodes with characteristic glandular cancer. In these cases apparently the skin, the milk ducts and the gland tissues were successively infected while the new growth in the lymph nodes represents a true metastasis.

In urging the importance of taking every precaution against cancer infection, notwithstanding the fact that its infectiousness has not been proved, we simply suggest a wise precaution which can do no harm while it may do an endless

amount of good, because in case the disease is due to infection every additional case is a menace to others.

In the meantime it would be equally unwise to ignore the various other theories which have been advanced. According to Virchow's theory cancer is due to local irritation—either mechanical, as in the form of friction; or pressure, as in smokers' cancer and the cancer of betel-nut chewers; or chemical, as in paraffin-workers and chimney-sweeps; or electric irritation, as in *x*-ray workers; or heat, as in workers in certain trades. This theory has an important practical bearing because by avoiding all of these forms of irritation undoubtedly many cases of cancer can be avoided, according to the view of those believing in cancer infection, because the soil has not been prepared for the infection.

Cohnheim's theory of embryonic origin, Hanseman's of "anaplasia," Ribbert's of "tissue tension" and Adami's of "habit of growth"—all aid in explaining the development of cancer; but in each instance the seed in the form of some kind of infection is missing.

The fact that cancer is a disease of old age can be reasonably explained from the fact of (1) reduced resistance; (2) long years of exposure to irritation; (3) long time of exposure to cancer infection. The fact that cancer occurs upon the exposed portions of the body and not upon the parts covered with clothing would point toward the fact that the exposed portions are not only more exposed to external irritation but also to infection. In the case of the Kongri burns of Kashmir, which cause cancer of the abdominal skin underneath the charcoal warmers worn over the abdomen, we have the constant irritation coupled with the fact that these people are extremely uncleanly, so that no part of their bodies is free from infectious material.

Cancer occurs almost exclusively in portions of the body exposed to the irritation of the outside world. This includes the gastro-intestinal canal, which comes in contact constantly with filthy food in locations in which stasis ensures long-

continued contact and persistent irritation. We find a notable example in the enormous amount of cancer of the stomach

India Per cent. of Carcinoma deaths		*Japan* Rate per 100,000 population
0.0	Stomach	52.3
0.0	Œsophagus	12.4
6.0	Liver	7.3
8.0	Buccal	2.3
1.4	Larynx	2.3
13.2	Skin	0.8
13.0	Breast	0.6
6.0	Uterus	11.0
18.0	Male genitalia	0.?

TABLE I.—Shows the difference in distribution of cancer to different parts of the body in races whose habits of living are very different, the parts of the body exposed to contact with filth being extensively infected with cancer.

TOTAL CANCER MORTALITY PER 100,000

Copenhagen	161.3
Berlin	133.5
Amsterdam	116.7
London	111.7
Rome	100.5
Moscow	94.8
Sydney	90.1
Petrograd	85.6
Buenos Ayres	85.1
Chicago	78.9
New York	77.1
Tokio	73.6
Osaka	55.9
Calcutta	11.7

TABLE II.—Shows the number of deaths from cancer per 100,000 of population in different important cities.

in manure eating people, *i. e.*, people eating raw vegetables growing in soil fertilized with night soilings or with barnyard

manure. A marked example of this is found in the Japanese who eat such vegetables in abundance and who suffer greatly

HAWAII, 1911–1913. RATE PER 100,000 BY RACE AND ORGAN.

	Total	Breast	Face	Int.	Stomach	Uterus
Japanese	19.8	0.0	0.0	12.1	57.6	18.2
Chinese	26.5	0.0	8.3	0.0	50.0	16.7
Portuguese	58.0	3.7	0.0	0.0	40.8	7.4
Hawaiian	93.8	13.7	0.0	2.0	27.5	29.4

Ceylon	5.6
Hongkong	8.1
India	11.7
Penang	10.3
Japan	60.2
Shanghai	55.3

TABLE III.—Shows death rate per 100,000 by race and organ.

	Stomach and Liver	Int.-Rectum Peritoneum	Breast	Skin	Buccal cavity
Switzerland					
Holland					
Japan					
Scotland				not given	
Uruguay					
England and Wales					
U. S. A.					
Australia					

TABLE IV.—Shows the relative frequency of cancer in different organs for various countries.

These tables were constructed from statistics taken from the volume published by Frederick L. Hoffman, statistician of the Prudential Life Insurance Company, who has given the subject an enormous amount of attention.

from cancer of the stomach, while the inhabitants in parts of India whose religion commands them to boil food and drink are notably free from stomach cancer.

On the other hand the Japanese are scrupulously clean regarding their skin, being habitual bathers in hot water. They are very free from external cancer. The people of India, on the other hand, who are not clean as regards their skin suffer largely from cancer of the skin. The same is borne out among the manure-eating animals. Barnyard fowl are notoriously unclean in their diet, and those individuals that do not lose their lives while young are very prone to suffer from cancer. The same is true of the pig, although, according to our modern methods, these animals are marketed so young that they rarely reach the cancer age. Is it not possible that the Jewish law prohibiting the eating of pork may have been founded on such knowledge? The same is true of dogs, rats and mice, who are all subject to cancer, while animals like rabbits and others eating clean food are practically free from cancer.

Marine and Gaylord have shown that fish living in ponds infected with excrement develop cancer, especially of the gills, which are the least protected part of the body, constantly in contact with the soiled water; while control animals living in pure water will remain free from this disease. There are many facts which seem to point to sewage and manure as the home of the organism causing cancer. Behla made a careful study of Luckau and found that cancer was four times as common in the low-lying portions as in the higher regions—in other words, in the portions to which the drainage was carried. He also found much cancer in dogs in this region. He also found that the communities afflicted severely with cancer consumed large quantities of home-grown vegetables. In this part of the country human excrement is used extensively for fertilizing vegetable gardens. Haviland also found after careful analysis that low-lying districts are full of cancer. Mason in his careful investigation of 400 cases

at Leamington, England, came to the conclusion that sewage is an important factor in the production of cancer.

An apparent discrepancy comes from the statistics of the city of Edinburgh, showing that cancer was found to be more frequent in houses demanding a high rent while tuberculosis was more frequent in houses of low rents. However, it seems clear that the former occupants could afford to eat raw vegetables while the latter had to be satisfied with porridge and less expensive foods.

Again, Meldorf states that of 1500 patients in Esquimaux only 1 per cent. had tumors and that only a few of these were malignant. The low percentage of cancer in the Arctic regions has been confirmed by many other observers. In these regions no vegetables are grown which are fertilized with human excrement and manure, hence there can be no contamination with human excrement. An important exception to this is the city of Hammerfest, but I have not the data concerning its food-supply nor its water and sewerage systems. In the tropics observers agree that cancer of the stomach is extremely rare. Here, again, this form of contamination is absent except where the vegetable gardens are conducted by the Chinese or Japanese. In the tropics human excrement is not used in fertilizing garden vegetables because these grow vigorously without this aid. Moreover, fruits are so plentiful that they are used in preference, and, of course, these are not easily contaminated.

In studying the statistics I have been impressed with the fact that cancer of the alimentary canal is uncommon wherever food and drinking water are not contaminated with sewage or manure. An interesting observation has been made in the case of the Chinese, who drink no unboiled contaminated water but who eat an abundance of vegetables fertilized with human excrement. As might be expected, they show a high mortality from stomach cancer.

The most convincing argument, however, of the infectiousness of cancer lies in the studies of Professor Smith, who has

proved to the satisfaction of those competent to judge that cancer in plants is due to microörganisms which he has been able to isolate and cultivate and which produces cancer when inoculated upon healthy plants. In human cancer further studies are needed, and it is hoped that these will be continued vigorously and that in the meantime healthy persons be not exposed unnecessarily to cancer infection.

The fact that none of the many observers like Roppin, Schill, Francke, Lampiasi, Scheuerlen, Konbassoff, Doyen, Wickham, Thoma, Sjobring and many others have been able to prove, to the satisfaction of others, that they had found the microörganism causing cancer must not be construed to prove that such an organism does not exist, because precisely the same failures were experienced before the tubercle bacillus, the bacillus of leprosy, the spirochete of syphilis, the plasmodium of malaria and many others were finally discovered. Clinically all of these diseases were infectious, and it was only a matter of patient labor to find the living cause.

Since writing the above paper, Dr. John W. Nuzum reported to the Chicago Surgical Society, on May 6, 1921, the isolation of a specific staphilococcus which he obtained from mouse cancer, the pure culture of which enabled him to produce typical cancer in healthy mice. His experiments extended over a period of two years, during which time he consumed more than twelve hundred mice. The article is to be published in Surgery, Gynecology and Obstetrics.

CANCER OF THE UTERUS

By John B. Deaver, M.D.
Philadelphia, Pa.

and

Stanley P. Reimann, M.D.
Philadelphia, Pa.

Very often it must seem as though the pursuit of the cancer problem were like chasing the elusive will o' the wisp. But the vocabulary of the scientist contains no such word as fail, and surely some day the solution will be at hand. It may burst upon us from some hitherto unsuspected source, but it is sure to come, for it is inconceivable that all the investigations that are devoted to this subject should be fruitless. Without an exact knowledge of the causative factor of cancer we cannot, of course, expect to prevent its development; but until that time arrives no means of mitigating its evil should be untried. There are not a few indications that the surgeon may be asked to lay down his knife as far as cancer, more especially cancer of the uterus, is concerned and make room for radiotherapy, either roentgen-ray or radium, or what seems the more satisfactory method, a combination of the two.

One of our English colleagues in discussing these methods in the treatment of uterine fibroma laconically remarks, "When the pen has superseded the sword the scalpel will still be needed for myoma." I believe this also applies to cancer of the uterus in spite of the very gratifying reports concerning the non-operative treatment of these cases.

As in all types of disease the demand for early recognition of cancer and of precancerous changes is imperative. But we are confronted with the question, is early diagnosis possible? If the answer to this question cannot be definitely positive it can at least be said that certain clinical phenomena are suggestive and sufficiently so to command attention. Among such suggestive clinical signs may be mentioned intermenstrual bleeding, increase in quantity, duration and periodicity of the menstrual period in the active uterus, especially at the onset of the menopause, and a bloody discharge after the latter has been established. The character of bleeding between periods may vary from a slight discharge to what might be termed hemorrhage, and is usually excited by irritation, as during urination, defecation or by examination or manipulation. The latter particularly should arouse suspicion, as it is in all probability due to erosion of capillary vessels influenced by the tumor cells.

The character of the vaginal discharge is also suggestive. In the incipient stage of cancer it may differ from the normal only in amount or it may be serosanguineous, but it is usually in a later stage that it becomes distinctly blood-stained, while in the advanced stage it is purulent and foul-smelling.

As in nearly all forms of internal cancer, pain is, unfortunately, not an early symptom of uterine cancer. Indeed, owing as much as anything to the poor supply of sensitive nerves in the cervix and the body of the uterus, pain is an indication of infiltration beyond the uterine limits and is thus a most discouraging sign. But, as I have said, these signs are merely suggestive—diagnosis must rest on careful inspection and digital and microscopic examination. The latter is of the utmost importance. That is to say, careful examination of the products of curettage or an excised portion of the cervix is of immeasurable value as a diagnostic aid in detecting carcinoma that might otherwise be overlooked. If only one case in a hundred thus examined proves positive for carcinoma the procedure is justified. Curettage should include the body and fundus as well as the cervix.

The predominance of cancer in the cervical portion of the uterus is well known. This fact is of importance in the association of carcinoma and fibromyoma. For this reason chiefly, and also to prevent an obstinate future vaginal discharge, it is my practice in all cases of fibromyoma of the uterus approaching the menopause, in the menopause or after the menopause, to do a complete removal. Statistics show that 2 or 3 per cent. of myoma uteri are associated with carcinoma of the cervix. It is readily seen that in precisely that proportion of cases the examination of cervical scrapings with positive results will indicate a total hysterectomy where otherwise a subtotal operation might have been done, thus contributing to the list of cases of cancer of the cervix developing after a supravaginal hysterectomy.

Curettement, however, has its serious limitations, inasmuch as material taken from one portion of the uterus may be entirely free from suspicion while malignancy may possibly be lurking in another part. In view of this it seems to me that the more rational method of obtaining information would be by direct inspection by means of a hysterotomy, a method which I have advocated on many occasions and practised with entire satisfaction. It is an open method, and in this consists its greatest advantage.

It is perhaps a fortunate thing, from a diagnostic standpoint, that the cervix is the more common site of uterine carcinoma, and it is important in this connection that in this location it spreads very rapidly, causes earlier fixation of the uterus and extension into the broad ligaments and walls of the vagina. Of value also is the fact that carcinoma of the cervix in the vast majority of cases develops in women who have had children. Very often there is present a laceration not entirely healed and presenting a reddened, eroded surface covered with a discharge and giving evidence of chronic inflammation. The pathologist sees in these cervices ulceration of the mucosa, irregularities in the epithelium covering the edges of these erosions, dense scar tissue distorting and ensnaring epithelial cells piled on the lining, cystic dilatation

of the glands with distortion of the lining epithelium and the like. It is not at all unusual for me to receive pathological reports which read: "Cannot tell whether this is carcinoma or not, but it may be." In such instances I do not hesitate a moment about removing the uterus. Curettage or any other time-wasting procedure has no place here.

The pathological changes that lead to cancer of the body and the fundus of the uterus are not so clear. But there are certain evidences of glandular hypertrophy, excessive secretion and desquamation with subsequent hyperplasia of lining cells which are, to say the least, suggestive of precancerous conditions.

When I do a hysterotomy I, of course, look for great shagginess, ulceration, fragile hemorrhagic endometrium, and also on the line of incision or on any suspicious looking area, for a sharp line of demarcation between endometrium and musculature. Very often normally there are a few glands beyond the line of the endometrium, but in general the dividing line is fairly sharp. Whenever I see tissue like endometrium invading the musculature I am suspicious and do not hesitate to give the patient the benefit of the doubt.

In the presence of undoubted cancer, complete hysterectomy is probably as sure a means of curing the disease as we have, provided, of course, that the growth is not so far advanced as to threaten adjacent tissues. It is these cases also that the radiologist believes are the most amenable to their treatment. This may be so, but it has not been my experience. I have too often seen an apparent regression of the tumor for several months after radium treatment, only then to be confronted with evidence of recurrence. This may possibly be due to faulty technic, but the same holds good, to a large extent, with regard to surgical failures. There is, however, less excuse for the latter, since the technic of the operation enjoys a certain degree of perfection, although at the same time it requires skill and experience. Radiotherapy, on the other hand, may be said to be still in its formative

period, but its technic is probably more easily acquired. The gist of the matter no doubt is that the tyro in either method helps to discredit the one as he does the other.

Unfortunately the surgeon so frequently sees the baneful effects of radiotherapy in cases that were either mishandled or unsuitable for the treatment that it is only natural that he should not sing its praises in loud tones. Not long ago I had occasion to operate upon a woman who, under a diagnosis of cancer of the uterus, had been treated elsewhere with radium, the dosage and time of exposure of which I do not know. She was brought to the Lankenau Hospital with evidence of peritonitis and an abscess in the cul-de-sac. I drained the abscess and did a hysterectomy. The woman died two months later following a stormy, septic course. Autopsy showed sloughing masses in the sigmoid, perforations, etc. No evidence whatever of carcinoma could be found in spite of the most painstaking search and section study of the uterus. The pathological diagnosis consisted of a small subserous myoma. This, of course, is a case of mistaken diagnosis and in no way reflects on the efficiency of radium, but it does illustrate the dangers of its use in inexperienced hands.

On the other hand the pathologist of the Lankenau Hospital, Dr. Stanley P. Reimann, has made a study of uteri removed, surgically, from one to five weeks after treatment with radiation. Of two particular cases the one, a squamous-cell carcinoma of the cervix, showed great destruction of carcinoma cells with intense congestion and polymorphonuclear and other cell infiltration. The destructive effect was seen throughout the length of the cervical canal and extending about $1\frac{1}{2}$ cm. into the wall, but *beyond this were numerous living carcinoma cells.*

In the other case, which clinically presented continuous small hemorrhages and aroused the suspicion of carcinoma of the fundus of the uterus, the uterus was soft and boggy, the entire uterine cavity giving evidence of intense inflammatory reaction, the mucosa and considerable muscle tissue

immediately about the site of the radium being necrotic and deeply ulcerated. The remainder of the mucosa also showed ulceration extending from a part to a whole of this structure. Beyond the necrotic area here, likewise, there were living carcinoma cells.

My remarks have been made on the basis of 500 hysterectomies performed by me at the Lankenau Hospital since January 1, 1916. These 500 cases comprise carcinoma of the uterus, 27 (no deaths); myoma uteri, 367; diseases of the uterus, tubes and ovaries, 106, among the last being 6 ovarian cysts associated with malignancy. The operative mortality of the entire series was 2 per cent., 10 deaths. The details appear in the table given below.

In conclusion, I would say that there is no gainsaying the fact that for certain well-selected cases, more especially inoperable ones, radiotherapy has a tremendous field of usefulness. If the day is at hand when it can be judiciously and successfully applied to all cases of cancer, none would more eagerly hasten the time than the surgeons themselves. The object of the profession at all times is to mitigate the effects, or if possible to rid the world of cancer, one of its most distressing sore spots.

		Number.	Deaths.
Myoma uteri		367	6
Chronic cervicitis		10	
Chronic endometritis		32	3
Salpingo-oöphoritis		18	
Prolapse, uterus		20	
Prolapse, vagina		2	
Vesicovaginal fistula		2	
Ectopic pregnancy, left cornu		1	
Bicornuate uterus with chronic endometritis		1	
Ovarian cyst (malignant, 6)		14	
Acute suppurative endometritis		5	1
Hydatidiform mole		1	
Carcinoma of the uterus		27	
Cervix	11		
Fundus	12		
Chorio-epithelioma	2		
Carcinomatous polyp	2	—	—
		500	10

RADIUM IN CARCINOMA OF THE UTERUS

By William Kohlmann, M.D.
New Orleans, La.

With the discovery of the remarkable power possessed by radium, this element has been eagerly adopted by the medical profession as a symbol of hope, offering prolonged life and freedom from suffering to a great number of cases of cancer which, formerly, would have been considered absolutely hopeless, and whose only temporary relief was morphin, which could merely alleviate the suffering for a short time, and soon even this means would lose the power of deadening the pain. In the past few years, radium is being more and more used in the treatment of malignant disease, and the excellent and surprising results achieved in many cases, especially as a palliative measure in inoperable carcinoma, could not fail to impress the profession with its importance as a valuable adjunct of surgery in the treatment of malignancy. Moreover, in many instances, it is not only an adjunct, but may be compared very favorably in its effects with the results obtained by surgical measures, and frequently, in cases in which surgery fails, it will bring about relief and even apparent cure.

The unsatisfactory results achieved by surgery in carcinoma of the uterus, especially in carcinoma of the cervix of the uterus, are only too well known. The radical operation which, through the efforts of Rumpf, Clark, Ries and others, has been developed in the last decade of the past century,

and has been improved and perfected in many details by Wertheim, whose results, reported in 1898, showed a generally considered high percentage of cures, has been employed for a number of years. The high mortality of this operation in all cases, with the exception of the early cases, in the hands of the most competent operators, and the complicating sequelæ, which frequently follow the operation, has soon brought this method into disfavor. Janeway has given interesting statistics showing the results of this operation,[1] and with scarcely any exception these are the experiences of every operator. Considering the low operability, high operative mortality and the low percentage of cures, the possibility of a new treatment, which promised better results, was generally welcomed.

In contrast to this drastic course of treatment the palliative and even curative results by radium have been surprising, and this fact has brought forward a number of questions, *i. e.:*

1. Whether radium should be applied only in inoperable carcinoma, and after surgery has failed.

2. Whether it should be used in assistance to surgery, as pre-operative and postoperative radiation.

3. Whether it should be given the preference—that is, as the only treatment without any surgical interference whatsoever.

In inoperable carcinoma the treatment with radium is accepted today as the treatment of choice. It accomplishes, without any great risk, more than any other method of treatment, and in some instances the primary results achieved by its application have been quite marvelous. In the treatment of recurrent carcinoma after panhysterectomy the reported results are not satisfactory, although some primary improvement can be noted. Twelve such cases came under my observation, of which number 4 died; 5 could not be

[1] Surg., Gynec. and Obstet., September, 1919.

traced (probably have died), and 3 have been clinically well for two and a half years.

Pre-operative radiation might have a distinct value but should be followed by early operation not later than four weeks. If radiation is repeated and operation is postponed the tissue changes have progressed to such a degree that the surgical procedure is difficult. I have operated on four such cases two or three months after radiation. No special benefit could be noted in regard to the progress of the disease. As a routine treatment I employ postoperative application of radium. Nine cases have been treated in this manner, of which 3 are well for over three years, 1 is well for over one year, 1 is living but not improved, and 4 are dead. Great care is necessary in the application of the radium because of the formation of cicatricial tissue due to the previous operation and the close proximity of the bladder and rectum. If particular attention is given to this fact and careful screening applied I believe the danger of fistula can be avoided. Postoperative radiation by the roentgen ray might be preferably applied and is the method which I employed before radium was at my disposal.

In regard to the question as to whether radium should be the treatment of choice in early and operable carcinoma there is no uniformity of opinion thus far. As, however, radiotherapy in the course of time is making itself more and more felt we will soon have to make a decision as to whether surgery, combined with pre- and postoperative radiation, or radium alone is to have the preference. He who believes that postoperative radiation is advisable is primarily a believer in radiation and must be firmly convinced that radiation influences carcinomatous tissue, which may not have been removed, and destroys cells for a certain distance, or at any rate checks their growth. During the last few years I had occasion to employ radium as the only treatment in a few early cases where surgery, on account of complicating disease, was contraindicated. The results in these cases

have been in the highest degree satisfactory, and so far the most extensive surgical operation could not have surpassed the results obtained, with the exception of one case, which, after primary improvement and apparent cure, suddenly had a fulminating recurrence which was followed by death due to hemorrhage. This case was complicated with diabetes, and it is possible that the constitutional disease was to some extent predisposing to the rapid, violent recurrence. Von Seuffert mentions the fact that in constitutional diseases, lues and especially diabetes, great care should be exercised.

Six cases of this type have been under my observation, of which 1 is free of symptoms without any treatment for over three years; 1 is free of symptoms without any treatment for over one and a half years; 2 are free of symptoms for six months; 1 could not be traced, and 1 died. A cure of this kind seems to be more certain and to be expected more free from the danger of a local recurrence, as there is no danger of spreading carcinoma cells over freshly cut surfaces, and in this way grafting the malignant disease on to healthy organs during the operative procedure.

History of Cases. Mrs. St. M., aged fifty-one years, T. I. No. 61359. Up to eight months prior to admission the patient was in good health. Menses regular, every twenty-eight days, lasting four days; no pain. Since, slight vaginal discharge, with blood, no odor. Loss of weight. Vaginal examination revealed enlarged cervix, posterior lip especially thickened and ulcerated. Diagnosis was carcinoma and was confirmed by microscopic examination of small section. Patient having symptoms of early pulmonary lesion, radical operation was not advisable. Treatment: July 19, 1917: 50 mg. radium vaginally; July 30, 1917: 50 mg. radium vaginally; August 8, 1917: 25 mg. radium vaginally. Patient began improving; vaginal ulceration had entirely disappeared. September 10, 1917: 50 mg. radium intracervically. Since that time patient was under observation. Last examination: cervix small, soft and smooth.

Mrs. V., aged fifty-five years, T. I. No. 74645. Menses stopped two years ago. Had vaginal discharge for a few months. Attending physician advised radium in preference to operation on account of heart lesion. Cervix of uterus enlarged and ulcerated. Microscopic examination proved malignancy. Patient was at the time suffering from symptoms of cardiac decompensation. Treatment: May 6, 1919: 50 mg. radium for 8 hours; May 13, 1919: 50 mg. radium for 8 hours; May 20, 1919: 50 mg. radium for 8 hours; June 24, 1919: 50 mg. radium for 9 hours; September 9, 1920: 75 mg. radium for 12 hours. After a few days, cervix small and smooth. No discharge.

Mrs. M. A., aged forty-six years, T. I. No. 74713. Vaginal discharge at times bloody every few days. Regular menses every two or three months. Cervix thickened, enlarged; posterior lip ulcerated. Rush diagnosis: Carcinoma, diabetes complicating disease. Treatment: May 10, 1919: Curettage and 50 mg. radium intracervical; May 17, 1919: 50 mg. radium intracervical; 25 mg. radium vaginally; May 24, 1919: Improved: cervix feels small and smooth; September 8, 1919: Patient doing well. Apparently cured. 75 mg. radium for twelve hours; January 6, 1920: Patient returned. Posterior lip of cervix entirely destroyed, vaginal wall infiltrated. Had severe hemorrhage at home and had continued bloody discharge. 75 mg. radium vaginally for twelve hours. There was no relief and patient died a few weeks later.

Mrs. L. T., aged thirty-nine years, No. 55783. Had been losing blood from vagina for three months. In the beginning, and at times for the past month, continued bloody discharge. No pain. No loss of weight. Vaginal examination showed ulceration of cervix and slight involvement of vagina. Treatment: August 28, 1916: 50 mg. radium intracervically, 12 hours; September 7, 1916: 50 mg. radium vaginally, 12 hours; September 30, 1916: 75 mg. radium vaginally, 10 hours.

Mrs. E. de M., aged forty-eight years, T. I. No. 84529.

Ulceration of cervix; good deal of discharge for about six months. Treatment: August 4, 1920: 50 mg. radium intracervically for 24 hours; 50 mg. radium vaginally for 24 hours; September 8, 1920: 100 mg. radium vaginally for 24 hours. Cervix smooth and normal.

Mrs. M. E., aged forty-eight years, T. I. No. 85610. Carcinoma of cervix. Ulceration over posterior lip of cervix. Treatment: September 28, 1920: 50 mg. radium intracervically for 24 hours; October 29, 1920: 50 mg. radium vaginally for 8 hours. Ulceration has disappeared.

Frequently there is objection raised to the use of radium in the belief that the claims made in its behalf are not justified. We must not allow patients, and their attending medical advisers as well, to have the impression that radium is a sure and permanent cure in all, and especially in advanced cases, in which only palliative results can be expected. If radium is applied in early cases, before metastasis has occurred, a cure may be expected. Unfortunately, however, it is hardly possible to fix such a time with any degree of certainty. In advanced cases, in which metastasis has already occurred, especially when glands at a greater distance are affected, and which can scarcely be reached by radiation, permanent results cannot be expected.

This brings up the question, how far-reaching the effect of radium may be. The extent of this therapeutic effect of radium has to be investigated yet, and a great deal of experimental as well as clinical observation is still to be done in the next few years, which is possible with the increased quantity of radium at our disposal and the increased interest the medical profession is taking in its application. This in itself speaks for the general belief that great things are to be expected.

The effect of the radium radiation is considered to be noted at a distance of from 3 to 5 cm., depending on the quantity and quality of the ray, but the radiosensibility of the surrounding tissue has to be accounted for too. This

sensibility is varying, and is no doubt the cause at times of a marked irritability of the bladder and rectum in certain cases in which the same dose produces no such unpleasant irritating effects in other cases.

The combination of roentgen and radium radiation will have to be considered in the future in order to extend the area of radiation beyond the pelvis and to subject the iliac regions to the same intense treatment as the pelvic cavity. More attention has been devoted to this procedure in recent years, and it has been taken up by Seitz and Wintz under the name of Roentgen-Wertheim.

The effect of radiation in cases of carcinoma can be noted clinically in a very few days after the application. Three or four days after the treatment the infiltration and tumefaction of the cervix can be found diminished, a process which is gradually followed by the shrinking of the mass and infiltration of the broad ligaments. This action of radium is most probably due to destruction of the carcinoma cells and increase in the formation of connective tissue, which, by shrinking and cicatrization, has a tendency to interfere with the life of the carcinoma cells.

Considering a reduced blood supply and an increased development of connective cicatricial tissue, an important factor in the effect of the radium treatment, I have followed a method previously advised as an adjunct to cauterization, especially of the extensive type recommended by Percy, and have combined the ligation of the internal iliac and ovarian arteries prior to radiation or simultaneously, with the thought in mind to assist the effect of the ray by cutting down the blood supply and starving the diseased area. I have applied this method of treatment in twelve cases during the past three years. 5 were not benefited and died; 6 show primary cure, and 1 is unimproved, but still living after ten months.

Of the six showing primary cures 1 is well for 1 year and 8 months; 1 is well for 1 year and 7 months; 1 is well for

1 year and 5 months; 1 is well for 1 year and 2 months; 1 is well for 8 months; 1 is well for 3 months.

These cases were not selected and two were so far advanced that the ligature of the ovarian artery was impossible on account of infiltration. It is my opinion that some of these cases have been materially benefited by this method. Cases of similar type, under treatment at the same time, which were subjected to radiation only, did not improve or had recurrence after temporary amelioration of the local and general symptoms.

Since June, 1915, 96 cases of carcinoma of the uterus have come under my observation in my private work, and my service at the Touro Infirmary and of this number 56 were treated with radium only. All of the cases were examined microscopically and the clinical diagnosis of carcinoma was confirmed. With very few exceptions all cases were benefited and improved in regard to the general and local symptoms. Some of the cases had improved to such an extent that a cure could be hoped for. Cases, which did not show any improvement after one or two treatments have, as a rule, not been influenced even after prolonged treatment. Recurrences after apparent clinical cure by radium were observed mostly in six to nine months and further application in these cases had been without benefit. Almost all of these cases have been of a very advanced type and hardly any other method of treatment could have been employed without immediately endangering the life of the patient. Even if there were no marked results in regard to a permanent cure the palliative influence on the local and general symptoms was remarkable. Of 22 cases living today 1 is well for 4 years, 1 is well for 3 years, 2 are well for 2 years. (One of these has vesicovaginal and rectovaginal fistula.) The remaining cases of this group have been under treatment for less than twelve months. Of 22 cases which have died, 2 had been well for three years but died of intercurrent pneumonia; 1, a woman of thirty-

nine years, died free of recurrence for one and a half years, cause not determined.

The time of observation for the entire series has been too short to be able to speak of any permanent cure or even to compute a percentage, but the outlook is hopeful that at the end of a 5-year period there may be a fair percentage living, especially of the early cases, which have been treated by radium only.

To simplify the survey of the results I have put the cases under three large groups:

Group 1. Carcinomas that are early and easily operable: (*a*) Cases treated with radium only; (*b*) cases with panhysterectomy and post-operative radiation.

Group 2. Carcinomas that are doubtful and inoperable: (*a*) Cases treated with radium; (*b*) cases treated with ligation and radium.

Group 3. Recurrence of carcinoma after panhysterectomy.

	Living.	Dead.	No report.	Total.
Group 1:				
(*a*) . . .	4	1	1	6
(*b*) . . .	5	4	0	9
Group 2:				
(*a*) . . .	22	22	12	56
(*b*) . .	7	5	0	12
Group 3 . .	4	4	5	13
Total				96

In regard to the treatment, I am greatly indebted to Drs. Samuel and Bowie, radiotherapists of the Touro Infirmary, for their valuable assistance and coöperation. The technic that has been followed in these applications has been extremely simple. The silver tubes, $1\frac{1}{2}$ mm. thick, each containing 25 or 50 mg. of radium, after being placed in a 3 mm. brass filter, are covered by a soft rubber finger cot, the end of which is tied. This cot is then put into the cancer crater, which is present in most advanced cases, for twelve hours,

and the vagina is packed with sterile gauze to protect the rectum and bladder as far as possible. No retention catheter is employed. After one application the mass usually shrinks and a second application is then made intracervically. 50 mg. of radium covered by a celluloid capsule is introduced into the cervix and 50 mg. or more put into the still existing crater, or upper part of the vagina, and held there by a gauze pack.

In most cases these applications were made in eight- to ten-day intervals, three treatments in all, and then the patient was asked to return every four to six weeks for examination. If upon examination the patient is found improved and some infiltrated tissue is still present, applications are repeated. In cases in which no improvement could be observed, further treatment was without success. Many cases had been clinically well after three months. I have followed the rule of applying radium at intervals of three months in all inoperable cases which had clinically improved. In the earlier cases no further treatment was employed.

During the past year there was some slight variation in the method of treatment, and this change has proved so far quite satisfactory and is rather more convenient to the patient. The time of the first application is prolonged to twenty-four hours and repeated after six weeks for the same length of time.

ELECTRIC CONDUCTIVITY OBSERVATIONS ON MALIGNANT AND BENIGN TUMORS, WITH A FURTHER NOTE ON OPERATIONS FOR CANCER OF THE LARGE INTESTINE

By George W. Crile, M.D.
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I. Electric Conductivity Observations on Malignant and Benign Tumors. Physical chemists—Loeb, Lillie, McClendon and others—have shown that fertilization of the ovum is attended by an increase in permeability; that the state of the activity of cells, whether in the performance of their specific functions or in multiplying, is attended by an increase in permeability. There is evidence that permeability may be estimated by the electric conductivity, hence it seemed worth while to ascertain whether or not variations in electric conductivity might be an additional index of malignancy. One would infer that the electric conductivity of tissue in so active a state of multiplication as cancerous tissue would be higher than that of normal tissue. Accordingly, measurements of the electric conductivity of malignant and benign tumors and of certain precancerous conditions were included in a research on the electric conductivity of animal tissues under varying conditions which was in progress in our laboratory in collaboration with Helen R. Hosmer and Amy F. Rowland.

In this study we have measured specimens from 167 clinical cases, including malignant and benign tumors of the breast and of the uterus, carcinoma of the stomach and of

the rectum, malignant and benign tumors of the mouth and jaws and neck, *x*-ray burns, the several types of goiters, *e. g.*, hyperplasia, fetal adenomata, multiple adenomata, toxic adenomata, exophthalmic goiter, simple colloid goiter and thyroiditis. Whenever possible adjacent normal tissue has been measured for comparison.

Among the goiters the highest conductivities were found among the adenomata. Variations in conductivity are well illustrated by the following measurements of a goiter, one portion of which was malignant. Three specimens from this gland gave the following measurements (expressed in reciprocal ohms): Colloid portion, .00124; early degeneration, .00159; rapidly growing portion, .00346.

The highest conductivities were found in the degenerating adenomata and the malignant thyroids, the conductivities of the hyperplastic thyroids were lower, and the conductivities of the colloid goiters were the lowest of any of the pathological tissues studied. In this connection it is of interest to note that 95 per cent. of all thyroid malignancies in our series have occurred in adenomata.

In all instances in which comparative measurements were made the conductivity of the malignant growth was higher than that of a normal portion of the same organ, as is illustrated by the following examples:

Sarcoma of the Uterus: Comparatively normal portion, .00367; sarcomatous portion, .00550.

Mixed Tumor of Parotid: Comparatively normal gland, .00153; malignant portion, .00922; (2 sections), .01058.

Carcinoma of the Breast: Comparatively normal portion, .00225; carcinomatous portion, .00581.

Carcinoma of the Pylorus: Normal mucosa, .00126; base of growth, .00469.

In the light of these comparisons the following measurements of the conductivities of *x*-ray burns and of the adjacent normal tissues is significant:

Case I.—Normal tissue, .00103; *x*-ray burns, .00717.

CASE II.—Normal tissue, .00151; *x*-ray burns, .00366.

The outer growing parts of cancers showed a high conductivity in contrast with the conductivity of the central non-growing part—a contrast between activity and exhaustion in growth. For example:

Carcinoma of the Thyroid: Center of growth, .00101; periphery, .00528.

Carcinoma of the Uterus: Center of Growth, .00493; periphery, .00658.

While these studies are presented only as a preliminary report, in view of the uniformity of our findings, it would seem as if one should ascertain whether or not, in conductivity measurements, we have an added criterion whereby to estimate the presence of malignancy. If irritation of tissue is followed by repair, and if repair is achieved through increased cellular conductivity, a side light on the relation between irritation and conductivity, and the progressive steps leading to new growth may be found. In the above data we have evidence, but not final proof, that increased conductivity may prove to be a sign of malignancy.

II. A NOTE ON THE TREATMENT OF CANCER OF THE LARGE INTESTINE. The conception of the human organism as an electrochemical mechanism rests on the conception that each cell of the organism is a complete electrochemical unit which functions as an electric battery. The difference in potential between the nucleus and the cell body upon which depends the performance of this function is indicated histologically by the different reactions of the different portions of the cell to staining reagents.

The activity of the cell therefore depends upon the essential factors of the cell and nuclear contents and also upon the integrity of the semipermeable membrane. These essential factors are water, oxygen and normal acid-alkali balance. These fundamental needs of the cells determine the general line of treatment.

1. *Water and Oxygen.* In many diseases, especially as the stage of exhaustion approaches, and this is particularly true in the stage of obstruction in carcinoma of the lower intestine, the fluids in the body become saturated with by-products so that they no longer serve to wet the tissues. It is essential, therefore, that water be administered in sufficient quantities not only to supply the existent need but also to assure sufficient water for the cells during their increased activity in response to the operation. For the same reason water is required immediately after the operation. On the day before operation, therefore, and after the operation water is given by mouth and, if exhaustion is advanced, by hypodermoclysis.

To assure the conveyance of this water and of a supply o oxygen to the cells a sufficient blood-pressure and blood volume must be maintained. Therefore, if either of these factors be impaired a transfusion of blood is given before operation, and repeated after operation if required. If the myocardium is weak digitalis is given to assure the maintenance of the circulation of the increased blood stream, thus assuring the hydration and oxygenation of the cells.

2. *Acid-alkali Balance.* At the time of operation the cell must be especially protected against increased acid by-products. The principal causes of increased acid by-products incident to the operation itself are (*a*) increased metabolism due to the drive of the emotions; (*b*) increased metabolism due to trauma; (*c*) diminished oxygenation due to the anesthetic. To minimize or eliminate these factors (*a*) the patient must be protected against anxiety or fear of the operation or its outcome; (*b*) the technic of the operation must be planned so as to cause a minimum of trauma and local anesthetics employed in addition to the general anesthetic; (*c*) analgesia with nitrous oxide-oxygen should be employed—never full surgical anesthesia. Nitrous-oxide-oxygen analgesia provides the utmost protection to the patient. The patient is awake throughout the operation,

but is in a twilight state of consciousness into which the sensation of pain, but feebly, if at all, penetrates.

3. *Preservation of the Integrity of the Cell Membranes.* Electric conductivity measurements have shown that the first effect of ether is to increase the conductivity of the brain, while later, as the anesthetic progresses, the conductivity of the brain is progressively decreased. This would indicate an early increased permeability of the cell membranes, thus permitting an increased concentration of H-ions with a later decreased permeability, so that the cells become practically isolated from the benefits of circulation. That is, they cannot receive a sufficient supply of oxygen or water, nor can they discharge the accumulated products of the increased metabolism. During nitrous-oxide-oxygen anesthesia, on the other hand, the permeability of the cells remains practically unaltered.

The protective action of nitrous oxide-oxygen is indicated also by our direct measurements of the temperature of the brains of rabbits during ether and during nitrous oxide-oxygen by means of the thermocouple. Under continuous ether anesthesia the temperature of the brain declined steadily to the death point, whereas during continuous nitrous-oxide-oxygen anesthesia the temperature of the brain remained practically unchanged.

III. Practical Application of Electrochemical Theory. 1. From one to two days before the operation large quantities of water are given by mouth, by rectum, subcutaneously or by means of a Rehfuss tube.

2. If the patient is greatly reduced a transfusion of blood is given before the operation, and if required transfusion also is given after the operation.

3. If the myocardium is impaired digitalis is given until the action of the heart is improved sufficiently for the safe performance of the operation.

4. The operation is performed in two stages, allowing a

sufficient period after the preliminary colostomy to ensure the reaccumulation of the reserves of the patient.

5. The operation is performed under nitrous-oxide-oxygen analgesia plus local anesthesia.

6. A wide incision is made to ensure the minimum handling of tissue.

7. After operation hot-packs are applied to the abdomen in order to increase the functional activity of the liver.

8. In cases of cancer of the rectum radium is employed both before and after the operation. In cases of cancer of the large intestine radium is applied after the operation.

If these procedures are carried out in detail the patient leaves the operating room in approximately the same condition as he entered it and his convalescence is well secured. My associates and I have performed 175 operations for cancer of the large intestine. Of these my personal series has been 73, of which 53 operations, including 24 colostomies and 29 radical operations without a death, have been performed since the adoption of this general method based upon the above physical interpretation.

CARCINOMA OF THE PELVIS OF THE KIDNEY

By Alexius McGlannan, M.D.
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Tumors derived from the epithelium of the pelvis of the kidney are much more uncommon than growths having their origin in the more highly specialized epithelium of the parenchyma of this organ. Watson and Cunningham had only one tumor of the pelvis in a series of 98 growths involving the kidney. At the 1913 meeting of this Association, L. B. Wilson reported four tumors of the collecting portion of the kidney among 92 renal tumors.[1] McCown[2] reports 48 cases of papilloma of the pelvis of the kidney, which number includes 1 case of his own, 2 previously unreported cases of other observers and the remainder found in an exhaustive study of the literature. In the discussion of McCown's paper 8 more cases were reported, including that of Stevens.[3]

Practically all of the tumors of the renal pelvis have a papillary structure and in their onset are benign. A few reported tumors seem to have originated in flat masses of squamous epithelium, probably in an area of leukoplakia. The papillary tumors, like those of the bladder, have a marked tendency to malignant change. Such malignant change is certain to follow an incomplete removal of one of these tumors. Although in some of the reported cases the

[1] Annals of Surgery, 1913, lvii, 522.
[2] Jour. Am. Med. Assn., October 30, 1920, lxxv, 1191.
[3] Ibid., June 5, 1920, lxxiv, 1576.

tumor has been present several years, and apparently has retained its benign qualities, all these tumors are potentially malignant and should be treated with this fact in mind.

When the papilloma becomes malignant the architecture of the tumor is reproduced. As such a tumor becomes older the papillary arrangement will be lost in the deep infiltrating areas, and here the epithelial cells become diffuse as medullary or scirrhous carcinoma. The infiltrating tumor almost invariably grows into the parenchyma of the kidney and the cortex may be perforated.

Secondary growths seem to be produced by implantation. In this way the occurrence of complicating tumors down the ureter and in the bladder may be explained. Metastases by way of the perirenal lymphatics involve the upper lumbar lymph nodes about the aorta and vena cava. Late metastases occur in the liver and the lungs, but rarely in the bones.

No definite relation can be found between the development of the papillary tumors and the presence of stone in the kidney. That leukoplakia may be the result of calculous irritation and in turn be the source of a squamous-cell tumor is a possibility. There is great difficulty in studying the reported cases, because in very few incidences has the type of the tumor been definitely described.

Nephrectomy is required for the removal of these tumors. The ureter should be carefully investigated and as much of this organ as is indicated should be removed because of the danger of an implanted growth in its lumen. In many cases complete nephro-ureterectomy should be done. Some authorities believe the latter should be the operation of choice in all cases.

The symptoms of papilloma of the renal pelvis are fairly typical. Hematuria is almost constant and the quantity of blood lost may be sufficient to disable the patient. There is some blood in the urine almost all the time, and at intervals profuse hemorrhage occurs and may persist for days or weeks. The profuse bleeding is usually preceded by colicky pain,

Fig. 1.—The kidney opened out to show the cauliflower-like tumor filling the greater part of the pelvis and infiltrating the parenchyma. (Photographs by Mr. H. Schapiro.)

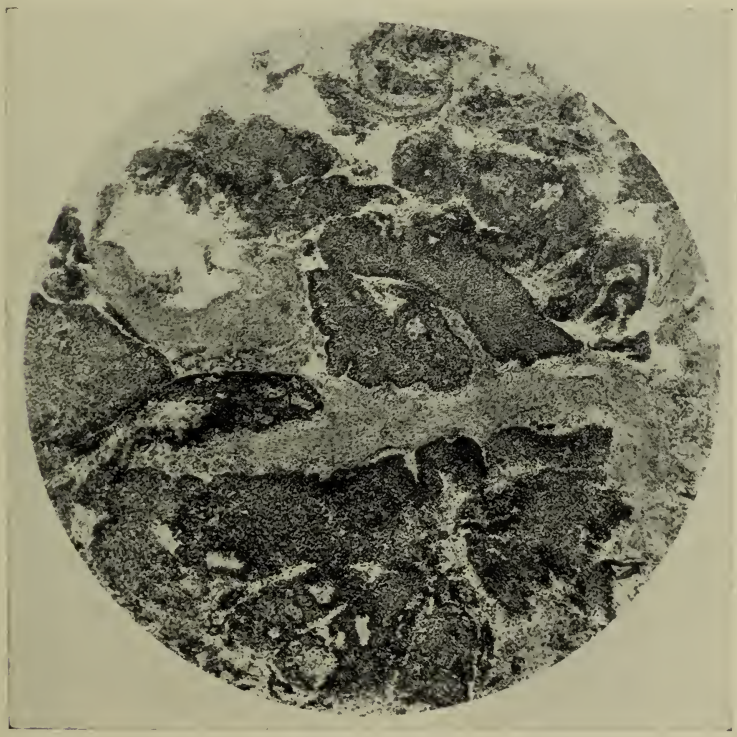

Fig. 2.—Low-power photomicrograph of the papillomatous area.

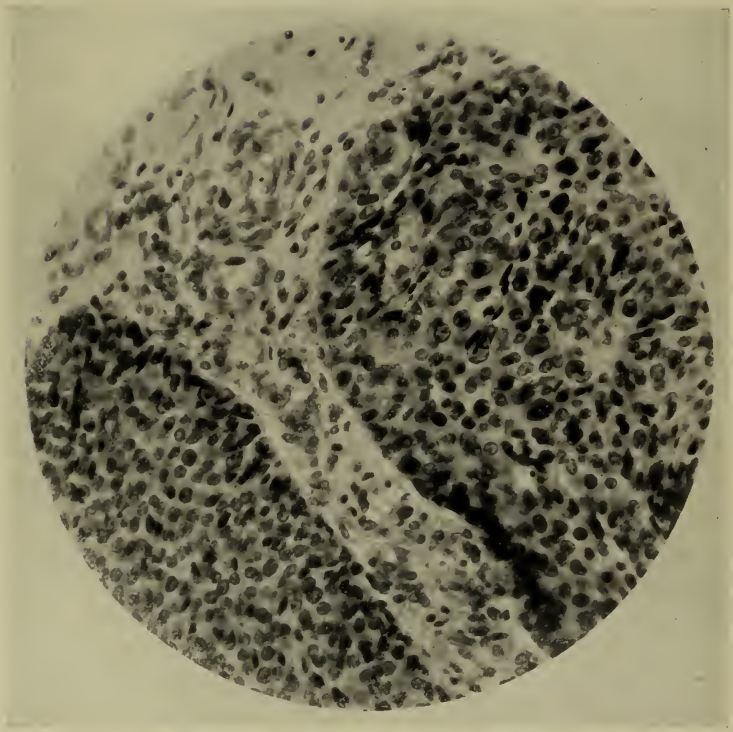

Fig. 3.—High-power photomicrograph to show the type of cell.

and this intermittent hematonephrosis is considered a characteristic symptom.[4] The presence of transitional epithelium in the urine is a valuable corroborative symptom.

The kidney is seldom enlarged by the growth and therefore a palpable tumor is not present. An accompanying renal calculus may be shown by the *x*-ray. After collargol or similar injections which visualize the kidney pelvis and calyces the *x*-ray shows alteration in the outline of the pelvis or some other deformity of this part of the kidney, varying in extent with the size of the tumor.

Cystoscopic examination will show the condition of the bladder and the side from which the blood comes. Catheterization of the ureter permits segregation of urine for functional tests. The function of the involved kidney is usually impaired. The differentiation from essential hematuria is not always easy. The bleeding from a tumor will not be controlled by the measures which are effective in essential hematuria, and in this lesion the deformity of the pelvis, as shown by *x*-ray, does not occur. Alteration in the function of the kidney, which is common with tumor, does not take place with the essential hematuria.

The case which I now report makes fifty-seven on record at this time, and is the eighteenth American case. B. S. H., No. 228. The patient, a white man, aged sixty-seven years, was admitted to the Bon Secours Hospital, Baltimore, February 22, 1920. He was referred by Dr. W. A. Glines, of San Juan, Porto Rico. The patient complained of persistent hematuria, weakness and shortness of breath. The hematuria had been almost constant for two and one-half years. There were occasional short periods when the urine seemed free from blood. After these periods he would have an attack of colicky pain in the region of the left loin, which would gradually subside as the bleeding returned. These attacks of intermittent hematonephrosis took place about once in three

[4] Israel: Quoted by Ransohoff in Keen's Surgery, iv, 247.

months. At the onset he had frequency of urination with some obstructive symptoms. An enlarged prostate was removed two years ago. After this operation the bleeding subsided for about a month. Thromboplastin and other coagulants were given at intervals during the next two years, but without effect. In January, 1920, Dr. Glines found transitional epithelium in the urine.

The physical examination, made on admission to the hospital, was negative, except for great pallor, a loud murmur at the base of the heart, palpable radial arteries and a little tenderness over the left kidney. The urine was a claret color, containing many red blood cells but no casts. The blood count showed 3,100,000 red cells with 50 per cent. hemoglobin, but no abnormal cells. Wassermann was negative.

Cystoscopic examination, on February 25, proved the bladder normal and showed the blood coming with each spurt of urine from the left ureter while the right side sent out clear urine. The patient was quite worn out when the examination had reached this stage, and therefore the ureters were not catheterized. *X*-ray examination was negative for stone. Because of the large amount of blood in the urine the phthalein test was unsatisfactory, but the blood urea was found to be 0.48 gram per liter.

A diagnosis of papilloma of the pelvis of the left kidney was made on the following points: There was bleeding from the left ureter with attacks of intermittent hematonephrosis; transitional epithelium had been found in the urine; the bladder was clear; *x*-ray did not show a stone; there was no palpable tumor; hypernephroma or other tumor of the parenchyma, of two years' duration, should have made a large mass.

On February 29 Dr. J. A. Ward gave the patient a transfusion of 500 c.c. of blood by the citrate method. On March 5 the red cells were 3,860,000 and the hemoglobin 60 per cent. A second citrate transfusion of 550 c.c. was given by Dr.

Ward on March 6 and the next day the red cells were 4,000,000 with 65 per cent. hemoglobin. A son of the patient was the donor on both occasions. Neither transfusion was followed by any disagreeable reaction.

Operation March 9. McGlannan. Anesthetic, ether, by S. G. Davis. The left kidney and four inches of ureter were removed by lumbar nephrectomy. To avoid transplantation in the wound the cavity was packed with alcohol sponges during the delivery of the kidney and before closing was flushed with alcohol. The wound was closed with a cigarette drain. The postoperative course was uneventful and the patient was discharged April 2, free from symptoms. He is now well, nine months after operation.

Gross Pathology. The kidney is small and the cortex narrow. The cauliflower-like growth occupies the entire lower half of the pelvis and branches out into the upper half. The base of the papilloma is hard, definitely malignant and infiltrates the parenchyma of the kidney almost to the capsule. The tumor, however, is clearly confined to the kidney. The ureter is free from any growth or extension.

Microscopic Pathology. The papillomatous structure of the tumor is preserved in the greater portion of the section, but several areas of epithelial cells are found in irregular nests without any definite arrangement, making their portion of the growth medullary carcinoma. There are no squamous cells nor areas of hornification. The tumor, therefore, is a malignant papilloma, becoming medullary carcinoma.

LIFE-EXPECTANCY FOLLOWING RADICAL AMPUTATION FOR CARCINOMA OF THE BREAST: BASED ON A CLINICAL AND PATHOLOGICAL STUDY OF 218 CASES

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and
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This study was undertaken for the purpose of determining as nearly as possible life-expectancy in patients in whom primary radical amputations of the breast have been performed for carcinoma. The factors which seem important in determining the expectancy of life were carefully studied from a clinical and a pathological standpoint in a series of 218 patients operated on in the Mayo Clinic for carcinoma of the breast. The conclusions arrived at from a study of the clinical findings and the findings at operation will first be discussed and then a study of the microscopic pictures of the tumors removed and the bearing which these different pictures seem to have on the prognosis will be considered.

It is impossible to foretell the duration of life in all patients with carcinoma of the breast because either the degree of malignancy varies widely or persons react differently to the disease. For instance, we see certain types of carcinoma of the breast which cause death within a few months after they are recognized and we see other types which metastasize slowly and do not prove fatal for many years. Such types, however, are rare and constitute only a small percentage of

the carcinoma of the breast, and it is possible in the majority of cases to make a fairly accurate prognosis as to the duration of life following operation.

It was gratifying to find from our statistics that the results obtained from early operation for carcinoma of the breast are probably better than those obtained in any other type of carcinoma with the exception of basal-celled epitheliomas and epitheliomas of the lip. The patients with carcinoma of the breast who apply for treatment may be classed in three groups:

1. A group composed of patients with inoperable growths. Such patients have growths which are firmly fixed to the chest wall; extensive ulcerating growths with metastatic skin nodules; fixed masses in the axilla; extensive involvement of the axillary and supraclavicular glands or internal metastases. Operation in such cases is of no avail and is probably harmful.

2. A group comprising patients who have removable growths, but in whom, either on account of the extent of the growth or the glandular involvement, a cure cannot be expected through operation. In such cases operation is often performed from a humanitarian standpoint without expectation of a cure but to relieve future suffering and discomfort.

3. A group which includes the patients with removable growths which may or may not have metastasized in the axillary glands. These patients have a chance for cure through operation, and it is the prognosis in this group of patients that we wish to discuss.

We found by studying the results obtained in 218 cases that 51.8 per cent. of the patients operated on—one of each two patients—were living three years after operation; 75.6 per cent. of the patients in whom the glands were not involved —three of each four patients—were living at the end of three years, and 36.6 per cent. of the patients with glandular involvement—about one of each three patients—were alive at the end of three years.

RESULTS OBTAINED IN 218 CASES OPERATED ON

Number of cases without glandular involvement.	Number alive five to eight years after operation.	Number dead.
86 (39.5 per cent.)	55 (63.9 per cent.[1])	31 (36.1 per cent.)
Number of cases with glandular involvement.		
132 (60.5 per cent.)	25 (18.9 per cent.[2])	107 (81.1 per cent.)
Total number of cases operated on.		
218	80 (36.7 per cent.[3])	138 (63.3 per cent.)

[1] Six (6) recurrences have occurred in these cases.

[2] Three (3) recurrences have occurred in these cases.

[3] Nine (9) recurrences have occurred in the entire group of cases operated on.

RESULTS OBTAINED IN PATIENTS UNDER AND OVER "50 YEARS" WITH AND WITHOUT GLANDULAR INVOLVEMENT

	Number of cases operated on.			Number alive five to eight years after operation.
Under 50	to 110 (50.5%)	with glandular involvement	69 (62.7%)	9 (13.0%)
		without glandular involvement	41 (37.3%)	26 (63.4%)
				35 (31.8%)
Over 50	to 108 (49.5%)	with glandular involvement	63 (58.3%)	16 (25.4%)
		without glandular involvement	45 (41.7%)	29 (64.4%)
				45 (41.7%)

THREE, FIVE AND EIGHT YEARS' CURES[1]

Decade.	No. of cases.		Number alive three years after operation.		Number alive five years after operation.	Number alive eight years after operation.
20 to 30	4	with glandular involvement . .	3	0	0	0
		without glandular involvement . .	1	1	1	1
30 to 40	31	with glandular involvement . .	16	4	1	1
		without glandular involvement . .	15	11	9	9
40 to 50	75	with glandular involvement . .	50	17	10	8
		without glandular involvement . .	25	20	16	16
50 to 60	59	with glandular involvement . .	28	10	8	8
		without glandular involvement . .	31	24	22	22
60 to 70	37	with glandular involvement . .	26	12	8	6
		without glandular involvement . .	11	7	6	5
70 to 80	12	with glandular involvement . .	9	5	2	2
		without glandular involvement . .	3	2	2	2
	218			113 (51.8%)	85 (39.0%)	80 (36.7%)
Total . . .		with glandular involvement . .	(132)	48 (36.6%)	29 (21.9%)	25 (18.9%)
		without glandular involvement . .	(86)	65 (75.6%)	56 (65.1%)	55 (63.9%)

[1] In thirteen (13) cases the exact date of death was unknown.

At the end of five years 39 per cent. of the patients operated on—about two of each five patients—were alive; 65.1 per cent. of the patients in whom the glands were not involved—about six of each ten patients—were alive five years after operation, and 21.9 per cent. of the patients with glandular involvement—about one of each five patients—were alive at the end of five years. Thirty-six and seven-tenths (36.7 per cent.) of the 218 patients operated on—about one of each three patients—were alive from five to eight years after operation. Sixty-three and nine-tenths (63.9 per cent.) of these died within five years after operation.

Age seems to have a definite bearing on the results to be expected following operation. Forty-one and seven-tenths (41.7 per cent.) of the patients over fifty years of age are alive from five to eight years after operation, while only 31.8 per cent. of those under fifty have lived for a corresponding time.

The immediate hospital mortality from operation for cancer of the breast was less than 0.5 of 1 per cent.

In our experience the prognosis has not been affected by the complete removal of small growths for microscopic diagnosis before the radical operation is performed. When local recurrences were found following operation, metastases were demonstrated in other regions in 60.9 per cent. of the cases—six of each ten patients. In our experience nearly all patients who develop a recurrence of the malignancy following operation die from the disease.

DISCUSSION OF THE SYMPOSIUM ON CANCER (PAPERS OF DR. BLOODGOOD, POWERS, OCHSNER, DEAVER, KOHLMAN, CRILE, McGLANNAN AND SISTRUNK)

Dr. William Carpenter MacCarty, Rochester, Minnesota, was asked to open the discussion. He said: Mr. President, it is always a pleasure to attend the meetings of this Association, and I am going to tell you why I came to these meetings. There have been two or three conditions which have always preceded and been responsible for epoch-making advances in pathology. The first condition which assisted the advance of pathology occurred about 1200 A.D., when Frederick II passed an edict allowing postmortem examinations. As a result our knowledge of gross anatomy and pathology rapidly progressed. The second great event was the invention of the microscope and its improvement by Leeuwenhoek, in 1677. This developed tissue pathology. The third great event or condition was the work of Schwann, Schleiden and other botanists who fixed our knowledge of cells as structural and functional units of plants. This stimulated Johannes Müller to think about cells as possible units of human tissues, and as a result Rudolph Virchow, one of his students, made the last epoch-making contribution to pathology; in the middle of the last century he wrote his *Cellular Pathology.* While Virchow wrote *Cellular Pathology,* he did not write cytopathology. He was dealing with dead cells; he was looking at cells through a low-power microscope; he did not see them as they really are. The next great epoch in pathology—and this is a prophecy—is going to be made as the result of modern operative surgery. I realized this a number of years ago and I have been coming to the meetings of the Southern Surgical Association ever since then because I wanted to be associated with the surgeons who are producing the conditions for another advance in pathology. Why do I want to be associated with surgeons and, at the same time, retain my interest in pathology? Tissue pathology has ceased to advance. You know that just as well as I do. Dr. Bloodgood said something about it this morning and something must be done. It can be done. The surgeon is the only man who can show us perfectly fresh human cells as they really are and the surgeon is the only man who is showing us these cells as they really are.

When I told some of my pathological friends a number of years ago that I was interested in cancer and related neoplasmata, they asked, "Who is doing your experimental work for you?" Having just a little Irish mixed with my Scotch and English blood, I answered, "I have two excellent operative technicians." "Who are they?" I replied, "Dr. William J. and Dr. Charles H. Mayo and their surgical associates. They furnish the material in the best condition. They are my experimental associates."

I have not time, as you know, to say much on each of the papers of the symposium. However, I wish to say I have never heard a better symposium on the subject of cancer before any society devoted especially to cancer. I never expect to hear a better series of papers before any cancer society in this country or in Europe. Each paper deserves at least fifteen to twenty minutes, but I shall not keep you here that long.

Dr. Powers, in his very excellent and valuable paper, said something about the early diagnosis of cancer, as did two or three of the other speakers, and as did Dr. Bloodgood this morning. I do not know whether or not you realize exactly what that means to you, as surgeons, in your work. I am going to tell you briefly what it does mean. If we educate people to come to us for what we call precancerous or possible cancerous conditions we must be able to differentiate precancerous and early cancerous conditions from those which are not precancerous or cancerous. Our clinicians make doubtful clinical diagnoses in 8 per cent. of all breast conditions that come to them. As we educate the lay people this percentage will increase instead of decrease. At the present time in our own laboratory over 20 per cent. of all pathological specimens must of necessity be diagnosed with the microscope, which means that you, as clinicians, surgeons or gross pathologists correctly diagnose grossly 80 per cent. of pathological lesions. This figure represents your precentage of gross diagnostic efficiency. The surgeon who only occasionally sees pathological material has a percentage of efficiency which is probably much less than this. In the next ten years this percentage will probably be decreased to 40, because the more we educate the public the smaller the lesions become. We study all specimens with dissecting microscope to improve our diagnostic efficiency. We do not rely absolutely on our gross diagnosis because we know its limitations. You surgeons will have to have associated with you

some such mongrel as I represent. I do not know what to call such an individual, but you will have to have someone associated with you who is intimately interested in your patients, sympathetic with you in your troubles, technical and otherwise, and who, at the same time, is familiar with biological and other sciences related to pathology.

Now where are we going to get such individuals? I do not know. The old-fashioned general pathologist would be of little value. Personally, I should be very happy to give any young man (and I am sure Dr. Charles Mayo will back me up in this) who wants to become such an individual an opportunity to do so. It is up to you surgeons to stimulate in young men the desire to be of such importance to the surgeon.

Dr. Deaver in his paper spoke about the early diagnosis of cancer of the uterus, and if you will permit me I should like to say a few words on that phase of the subject. In the last ten days I have made three diagnoses of carcinoma of the uterus upon cells alone. How did I know I was correct in my diagnosis? I sent word back to the surgeon to remove the uterus. He did so; the uterus was brought back to the laboratory and carcinoma was found. Some of these tumors were not more than 1 cm. in diameter.

In another case of carcinoma of the uterus the surgeon did not consent at first to do a radical operation, but an operation was performed several days later. The uterus was removed and brought to the laboratory when I was not present; a third man in the laboratory roughly looked at the uterus and passed it by because he knew a diagnosis of cancer had been made before. I said to him when I came back that the uterus might not have been carcinomatous. "Go and get the uterus and we will find out definitely." We found definite carcinoma in spite of the fact that it was not grossly visible.

With reference to radium, I should like to emphasize what Dr. Deaver has said. I have had the opportunity to examine many uteri that have been treated with radium, and I have not yet failed to find carcinoma left in the uterus. That does not mean radium has no place in surgery. Radium certainly has a place in surgery, because I have seen large carcinomata of the uterus melt away so that they were grossly invisible as a result of radium treatment; but I do not believe every case of carcinoma of the uterus should be treated with radium.

Regarding the paper of Dr. Sistrunk, I have been intimately

associated with him in studying these cases, and I might mention some of the conditions which we have found out in connection with 91 of his dead cases. He had 138 such cases out of 218. As a result of the shortness of time and the great technical difficulty in doing this work I was able to study only 91 of these cases, and I do not know which 91 I studied. One of the most important questions in cancer is this: We have had some patients live longer than others with apparently equal amounts of carcinoma, or even with a greater amount of carcinoma. Why do some live longer than others is an extremely important question. There are certain conditions which we see in sections of cancer which might be possible factors as a part of a defensive mechanism against cancer. One of these is lymphocytic infiltration. Personally I have an open mind regarding the importance of the lymphocytes. The second factor is fibrosis; the third factor is hyalinization; the fourth factor is cellular differentiation.

The sections from these breasts were studied independently of any knowledge whatsoever of the clinical history or the type of operation performed, or anything excepting what we were seeing under the microscope. I made the pathological examination and Dr. Sistrunk worked up the clinical and surgical facts. I shall give you some figures about the occurrence of lymphocytic infiltration, fibrosis, hyalinization and cellular differentiation in these breasts, and show you also figures which point out what effect they have on longevity in cancer of the breast.

In the first place, cellular differentiation occurred in 15 per cent. of all these specimens. Lymphocytic infiltration occurred in 62 per cent.; hyalinization occurred in 54 per cent., and fibrosis in 71 per cent. A combination of lymphocytic infiltration and fibrosis was found in 41 per cent.; that is, we found both in the same specimens. Lymphocytic infiltration and hyalinization occurred in 28 per cent. and hyalinization and fibrosis in 52 per cent.; lymphocytic infiltration, hyalinization and fibrosis combined occurred in 28 per cent.

The average length of life with lymphocytic infiltration alone in the specimen is 28 per cent. greater than the average length of life for these 91 cases. The average length of life without lymphocytic infiltration is 8 per cent. greater than the average length of life. So apparently lymphocytic infiltration is not the whole factor. The average length of life with lymphocytic infiltration, hyalinization and fibrosis combined was 37.8 per

cent. greater than the average length of life. You see the percentage has gone up a little when we add the factor of fibrosis. The average length of life without lymphocytic infiltration, hyalinization and fibrosis is 20 per cent. less than the average length of life and 40 per cent. less than the average length of life with lymphocytic infiltration, hyalinization and fibrosis. The average length of life with cellular differentiation is 51 per cent. greater than the average length of life and 50 per cent. greater than the average length of life without cellular differentiation. The figures are going up as you see. The average length of life with lymphocytic infiltration and fibrosis alone is about the same as the average length of life. The average length of life with lymphocytic infiltration and hyalinization alone is 44 per cent. greater than the average length of life and 44 per cent. greater than without lymphocytic infiltration and hyalinization. The average length of life with hyalinization alone is only 7 per cent. greater. Why, I do not know, but the average length of life with fibrosis and hyalinization is 71 per cent. greater than the average length of life, and is 482 per cent. greater than that without fibrosis and hyalinization. I do not know exactly what this means. In this series of 91 cases it looks like hyalinization plus fibrosis is a very important factor in determining longevity. Why should hyalinization be important as a determining factor? Cancer is an invasive condition. The cells are invading tissues. Hyalinized tissue has the greatest density of any tissue we have in the body excepting cartilage and bone. Increased density decreases penetrability. It seems to me that is a problem of ordinary physics.

What is the relation between lymphocytic infiltration, fibrosis and hyalinization? Lymphocytic infiltration, in my experience, is the first to appear; it is the first local reaction; fibrosis is the second reaction, and hyalinization is the third and last reaction so far as we know. The question of differentiation of cells I shall not go into on account of lack of time; we shall take it up on some other occasion. The more highly differentiated the cells the less their power of reproduction, hence the less the rapidity of growth. That is an unwritten law in biology.

Again I want to thank the president, officers and members of the Association as well as the essayists for this opportunity of being here and of really being inspired by the splendid contributions on cancer.

Dr. Henry O. Marcy, Boston.—Many years ago, while I was in Edinburgh, Scotland, Dr. Bennett declared to me his conviction that cancer was first local and probably disseminated through the lymphatics, and that as a consequence it was of the greatest importance to operate early with great care to remove all glandular enlargements. The general teaching up to this period had been that cancer was a constitutional disease and that operation at the best was only a palliative measure of relief.

Convinced of the correctness of Dr. Bennett's opinion, I have since surgically fought cancer, as our fire department does fire, with the conviction of having saved many lives. In my earlier studies I made cultures of material carefully taken from mammary growths. It was not difficult to differentiate a coccus which in repeated cultures bred true, but I failed to reproduce them by the inoculation in animals.

At this time I had been made aware of the sad experience of one of our younger members of the profession. The patient had developed a malignant growth of the face requiring frequent dressings. On one of these occasions, unintentionally, he rubbed his own face and inoculated a small abrasion. This was thought little of until later it spread rapidly and cost his life prior to that of his patient.

In one of my lectures I narrated the incident, regretting that the state should execute its murderers rather than make them subjects of scientific investigation. The Society for the Prevention of Cruelty to Animals investigated me, expressing their indignation that Dr. Marcy, who had for a long time kept his garden well filled with rabbits, guinea-pigs and stray dogs, the subjects of torture, should at last seek to prey upon subjects of his own species.

Just at this time of writing I learned of the death of our old friend Dr. Carstens, of Detroit, Michigan, from cancer of the mediastinum. He has long been a disciple of early operation, and only recently urged that the profession set aside one day a year in teaching the public the danger of delay.

Dr. J. Shelton Horsley, Richmond, Virginia.—Dr. Ochsner's very interesting statistics are suggestive, although his deductions are not convincing. If, as Dr. Ochsner claims, cancer is chiefly, if not entirely, caused by the contact of manure with tissue, it would be difficult to explain why cancer of the rectum, which is in constant contact with autogenous manure,

is not universal. It is also difficult to explain why cancer in the stomach is much more common than cancer of the rectum. As we know the contents of the stomach under normal conditions are practically sterile. Let us take sarcoma of bone. If we include it in the general class of cancer, it would be difficult to explain how sarcoma of the bone is due to tissue contact with manure. This is also true of cancer of the breast, which is one of the most frequent forms of cancer and occurs in a locality which in the male is not ordinarily exposed, and which in woman is to some extent protected. It is certainly far more protected than the face. It is also true, as these statistics show, that cancer of the buccal surfaces in the Indian from chewing betel nut is much more common than cancer of the bowel where manure is constant. Cancer of the lips or tongue from smoking a pipe is comparatively common, though the smoke is sterile.

Dr. Charles H. Mayo, Rochester, Minnesota.—I wish to express my appreciation of the papers that have been presented in this symposium and to congratulate the Association especially on having the paper of Dr. Powers in which he takes up the work of the Cancer Commission in this country. I am very glad the ladies were present during the reading of these papers, because I feel the presence of a few ladies will do more to disseminate such knowledge among the people than can be done by this entire body of surgeons.

We believe that in our various communities every effort should be made to disseminate knowledge regarding cancer. In the different communities you will find on the shelves of grocery stores and hardware stores just such commodities as are called for by the people; the work of professional people, men of brains, come under the same classification. If we make known certain necessities to the people of our communities they will ask for them, and unless we do this little or no progress will be made. Much work has been done in the past to advance medicine by the gradual education of the people; for example, relative to tuberculosis and the prevention of infectious diseases. We have shown how greatly we have improved in our ability to control cancer, but this has been done only by educating the people to come early for treatment and not because we can treat them better now.

Dr. Bloodgood has brought up the question of early or late operations. I would take issue with him regarding certain

points. He started out by discrediting the work of pathologists of this country, stating that more than 50 per cent. of them do not understand their business. I do not think that is true. It reminds me of an old Scotch minister who was called to a new parish. He went visiting among the parishioners, and after visiting a good many, an old lady talked with him and told him about each member. "Well," he said, "really, it seems to me, you and I and John are about the only ones above suspicion, and I have my doubts about John."

I differ absolutely with Dr. Bloodgood on the effect of papillomas and the bleeding breast. The question of attacking a papilloma of the rectum, a papilloma in the pelvis of the kidney, ureter or urinary bladder is important, as it may become malignant. I look upon papillomas as essentially and potentially malignant, but they may be operated on at a time when they are benign. If a good job is not done at the first operation the next time the tumor may be malignant. When a woman comes in with a bleeding nipple, or with a coffee color stain, look out for malignancy. The premalignant process may go on for two to six years, and it means a papillary growth of one of the ducts.

These tumors should be removed early, with removal of the entire breast only is sufficient, and I would rather have a poor surgeon do the operation early when the disease is confined to the breast than a skilful surgeon later when there is involvement of the surrounding tissues.

I want to speak of one point made by Dr. Crile. He has hit upon a real principle although an old one. When we began to develop chemistry, chemists took up the theory of electric combination; that is, the electron combined, its atoms and combinations in chemistry were electric. Then that theory was discarded and was taken up again in 1898, and is now the working chemical theory.

Dr. John G. Clark, Philadelphia, Pennsylvania.—I was particularly interested in what Dr. MacCarty has said concerning the relationship of a fibrosis and the cure or limitation of carcinoma. He alludes to the fact that in some cases in which radium has been previously used, cancer cells are still found associated with fibrosis. I believe that what he says relative to the cure of carcinoma is very important, as we have observed one case which bears directly upon this point. Over three and

one-half years ago we treated a woman with carcinoma of the vagina which was totally inoperable. The vagina at the time was contracted by the growth and we gave a comparatively small dosage of radium because we were afraid of producing a vesical or rectal fistula. Subsequent to the treatment she was very ill, and it looked as though she would survive but a short time. Indeed, we felt sure she was dead, but were very much surprised a year subsequently when her physician reported to us that she was apparently perfectly well. She returned to the University Clinic and we found a complete fibrosis of the vagina with occlusion. In the very center of this vaginal cicatrix there was a small carcinomatous area. We withheld further radiation on account of the possibility of breaking down barriers. The patient continues well, now more than three years, and only a few days ago she returned to us, and at the site of the carcinoma there was a firm, white cicatrix, and on excising tissue from this area not one carcinoma cell was found. This case has a very strong argument sustaining the theory which is shown so very clearly that fibrosis has a limiting effect upon the growth of cancer. Notwithstanding some of our very satisfactory results in many cases of carcinoma, we still adhere to the principle of operating upon those which are clearly within surgical limits. In this list, however, we find a much smaller number that we consider operable than we did before we had radium at our command. Our last review of our cases showed we had but 18 per cent. of cases alive after radiation, although they had been considered inoperable at the time of the treatment. These two remedies are of great value. Surgery and radium are of value in treating carcinoma, but neither will cure more than a small percentage of the large number coming to us for treatment.

Dr. R. C. Coffey, Portland, Oregon.—There is one point I would like to take up in connection with this symposium on cancer, and that is the transplantation of cancer cells during operation which relates to a number of suggestions made at this time.

Within the past month I have had four cases with cancer growths in abdominal wounds which I made personally within the last year, and in which the growth has not recurred at the point from which the cancer was removed. I think this must

be an extraordinary series of cases. Three of them are at the hospital at this time under radium treatment. In each of these cases during operation the cancer growth was broken down. One was a cancer of the stomach attached to the pancreas. There is no evidence at the present time, which is nearly a year after the operation, that there is involvement or recurrence in the stomach. Another case was one of cancer of the sigmoid flexure in which I removed a portion of the growth and left a colostomy opening. There is no recurrence of the growth in the intestine, but there is a recurrence in the wound about two inches below the point where the intestine was brought out. Another case is one of cancer of the uterus in which the uterus was removed. In this case the abdominal wall was infected with cancer, but there is no recurrence at the original site of the growth.

Another case was one of extensive malignant cyst in which we were unable to remove the cyst because of its attachment to other things. We opened it and removed the gelatinous cancerous tissue and packed with gauze, and applied 100 mg. of radium for twenty-four hours. There was no recurrence of the cyst, but there was extensive growth in the abdominal wound. The cancer was broken down in all these cases and there is evidence of cancer cells having been brought into the wound.

What I have said in connection with these cases bears out strongly a number of things that have been brought up tonight. I do not know what it means, for it is a curious thing that very few, if any, surgeons have really been infected with cancer. I have scars on my fingers made during cancer operations before I began to wear gloves, and notwithstanding the above evidence of transplantation of cancer cells, there is apparently no authentic record of surgeons becoming infected and developing cancer. The transplantation of cancer cells to wounds in the same patient during operation is a serious matter.

Dr. William J. Mayo a little more than a year ago called attention to the fact that he had had two or three cases or more in which he had done the Percy cautery operation, and no recurrences had taken place where the growth had been destroyed; but cancer had developed down in a little crack in the vaginal mucous membrane made during the operation of divulsion of the vagina for the insertion of the water-cooled speculum.

Dr. Thomas S. Cullen, Baltimore, Md.—I want to congratulate our secretary, Dr. Royster, on the selection of the speakers of the evening. We have had a delightful treat.

Dr. Powers has told us of the development and work of the American Society for the Control of Cancer, and incidentally was good enough to mention the share I had in launching the cancer campaign. A number of years ago, when I was getting together statistics on cancer of the uterus and was feeling very gloomy over the outlook, I wrote to Dr. Franklin H. Martin, of Chicago, and told him that I felt that notwithstanding our endeavors to cure as many cases of cancer as possible it was appalling to see how many patients came too late for operation. I further told him that it was absolutely essential that we enlighten the public as to what might be accomplished by early operation, and that if we did not do so we would continue to see hosts of inoperable cases. In reply he said, "Formulate your plans and we will bring the subject up before the Clinical Congress of Surgeons, which meets in New York in a few weeks."

To Dr. Martin we are in large measure indebted for the beginning of the campaign against cancer. At the Brooklyn meeting a committee was appointed and instructed to use the daily press, the weekly and monthly magazines for a campaign of education on the subject of cancer. Mr. Bok, the editor of the Philadelphia *Ladies' Home Journal*, and Mr. Karl Harriman, managing editor of the same *Journal*, became deeply interested in the campaign, and after careful consideration of the subject came to the conclusion that the best person to write a cancer article for their journal would be Mr. Samuel Hopkins Adams. He consented, and with his characteristic and well-known thoroughness at once set about to familiarize himself with the subject. We first had a dinner at the Maryland Club. Here he met a group of ten Baltimore physicians and surgeons who had been interested in the subject for many years. After the dinner the guests sat around the table for three hours discussing the cancer problem from every angle.

Mr. Adams, then, in order to temporarily forget the sad cancer picture he had gleaned from his Baltimore conference, journeyed to New Orleans and wrote up the Mardi-Gras for *Collier's Weekly*. He then visited the clinics of Chicago and Rochester, Minn., for more cancer data. After digesting the subject most carefully he wrote a two-page article on cancer for the *Ladies'*

Home Journal. Mr. Adams also published articles on the subject in *Collier's Weekly* and *McClure's Magazine;* thus the campaign was launched.

The *Ladies' Home Journal* article not only reached millions of people but it was widely copied by the daily press of the country. Let me give you just one example of what this publicity accomplished. A few months later, while en route to the meeting of the American Medical Association at Chicago, I saw Dr. LeGrand Guerry, of Columbia, S. C., and he told me that as a result of the *Ladies' Home Journal* article alone he had seen six early cases of cancer in a few weeks.

All of us should in every way heartily support the excellent work of the American Society for the Control of Cancer. This Society is not only backed by the profession but also by the laity throughout all parts of the country. It is doing wonderful work and should have the active coöperation of every member of the medical profession.

Dr. MacCarty has told us about the lack of surgical pathologists in all parts of the country. Let me suggest how this deficit may be overcome. Every surgeon looking around for a wide-awake assistant should insist that the applicant have at least one year's training in the surgical pathology of his special branch. The earnest young man will immediately appreciate its value and will at once place himself under the tutelage of a good surgical pathologist for a year at least. At the end of that time he will be invaluable to the surgeon and will in most instances be able to advise the operator during the operation as to the exact condition present, and whenever a frozen section is necessary a technician can at once make the necessary section and the assistant render an intelligent opinion then and there.

This clearing up of the diagnosis will not only enable the operator to do more intelligent work but will also be of great value to the patient. The assistant will likewise supervise the examination of all pathological material coming from the operating room. This will still further add to his knowledge of surgical pathology. In due time the assistant becomes a full-fledged surgeon himself, and, having realized to the full the value of a fundamental knowledge of surgical pathology, will insist that all those coming to him for surgical training shall be well grounded in the pathology of surgical diseases. In this manner there is no reason why the surgeons of the next decade should not all have a comprehensive knowledge of their own particular branch.

Dr. E. G. Jones, Atlanta, Georgia.—I have listened to Dr. McGlannan's paper with special interest owing to a recent experience which coincides somewhat with his. It may be only a theoretical source of comfort, but nevertheless a source of comfort, if the malignant kidney is on the left side instead of the right. Of those abdomino-aortic lymphatic glands which receive drainage from various viscera, only those which lie lateral to the aorta receive kidney drainage. That these same glands receive likewise drainage from the inguinal glands, from the sex glands and from the abdominal parietes is not material here. It so happens that the left juxta-aortic glands which receive kidney drainage are more favorably situated for removal than are the corresponding juxta-aortic glands on the right, because these latter lie partly in front of and partly behind the vena cava. On the left side, therefore, there is not such a degree of embarrassment as will arise on the right when in renal carcinoma an attack is made upon the next adjacent lymphatic glands, since in the latter case the enveloped vena cava may constitute a major handicap.

Dr. William B. Coley, New York City.—Most of what I had to say in regard to Dr. Bloodgood's paper has already been said by Dr. Charles Mayo. I have been much interested in the progress of dealing with cancer, and the subject has occupied much of my attention for a great many years. While there is a feeling on the part of many today that we are drifting back to the dark ages—and, it must be confessed, a study of world conditions gives some ground for this apprehension—I do hope it is not true in regard to the treatment of cancer. It was my belief that considerable progress had been made in the treatment of cancer of the breast until Dr. Bloodgood read his paper. I am sorry that he ascribes the brilliant results obtained by men who have given their lives to perfecting the technic of breast cancer to the fact that they got their cases earlier than other men—in other words, the results are due to chance rather than brilliant technic and wise judgment in the selection of cases.

In regard to the treatment of cystadenoma of the breast, I believe the breast should be saved. I do not believe the operation should depend upon any particular shade of blue in any cyst of the breast. I believe that the cyst should be taken out. Any benign tumor of the breast should be removed and examined carefully for evidence of malignancy so that later on the breast

can be removed if necessary. I believe with Dr. Mayo that many of these tumors are potentially malignant. In one case which came under my own observation Dr. Abbê inserted a needle, and because he withdrew a considerable amount of straw-colored fluid, pronounced it a benign cyst and allowed it to remain. Two or three years later the same patient came to me with an advanced carcinoma of the breast. If the whole tumor had been removed at the time of the original observation I believe the patient's life might have been saved.

In regard to Dr. Ochsner's paper I have for many years believed in the extrinsic origin of all types of malignant tumors, and each year of added experience more firmly confirms this opinion. The facts brought out by Dr. Ochsner this evening, are not only interesting but very strongly support this view. The cases cited by Dr. Horsley, I do not think, refute anything Dr. Ochsner has said. His reference to sarcoma following a local injury being difficult to explain on any infectious theory is unfortunate. If we take sarcoma of the bones we know that about 50 per cent. of the cases have an antecedent local trauma, and yet we have other bone lesions which we know to be of infectious origin, in which antecedent trauma plays an entirely analogous part. Many cases of tuberculosis in children are associated with antecedent local trauma. We know that, experimentally, we can inject a certain number of staphylococcus germs into a rabbit without producing any harm, and yet if the tibia of the animal is given a sharp blow, an osteomyelitis results. In other words the local injury produces a lowering of the local resistance of the tissues and furnishes favorable soil for the development of the germ. This, I believe, is exactly what occurs in cases of malignant tumors developing after local injury.

Dr. Ochsner (closing the discussion on his part).—I will discuss this one series of cases because it will enable me to emphasize some of the things that I could not present in the paper because it would have taken too long.

We have 652 cases of cancer in a population of 100,000 whose habits we know. We know that cancer develops under certain conditions, and the first of these is irritation. We know that cancer develops on the proximal side and not on the distal side of the pylorus. On the proximal side we have an acid medium and on the distal side an alkaline medium. In the intestine

between the pylorus and the ileocecal valve there is practically no cancer. Occasionally, but very rarely, a wound in the small intestine becomes infected with cancer. During that long distance, infectious matter, which was present in the stomach, has had excellent opportunity to become disinfected. Only a few microbes that are most virulent and resistant will get down to the colon, where there is an acid medium for them to develop in. If we have stasis and long-continued contact in presence of the acid medium a certain proportion of these cases will develop cancer in the colon or rectum, because here we have the conditions favorable for the growth. We know from other circumstances that unless we were well protected against cancer we would all die of it. If we have a pigmented mole it may remain quiescent for many years without causing any trouble because there is something that protects the body against cancer. If the mole is crushed the protection is broken down so that the infection from the pigmented mole has a chance to get into the general circulation and the patient is quickly covered with melanosarcomata of a very malignant type. It is reasonable to suppose that an organ, so constantly exposed to filth as the colon is, may be provided with an especially effective protective substance.

We have among the Japanese 0.6 of 1 case of cancer of the breast per 100,000 population. Here among the people of India, who are externally unclean but internally clean, we have 13 per 100,000 population. We know it is the habit of many women to moisten their nipples with saliva, and it is very likely that the nipples may become infected and cause the infection of cancer in that way.

Recently it has been proved that a large proportion of cases of mastitis in nursing women results from infection which evidently comes from suppurating eyes in nursing infants, caused by the sulphuric acid that is contained in the solution of argyrol that is used in children's eyes. The reason why the breast becomes infected with cancer so frequently very likely is because it is connected with the external world through the milk ducts. It would take an endless amount of time to explain all these statistics, but I am convinced that they can be worked out on the basis I have indicated.

Dr. Sistrunk (closing the discussion).—I should like to say a few words relative to the transplantation of carcinoma cells.

Every now and then we see a patient in whom a transplantation of carcinoma cells occurs throughout the entire operative scar. I believe it is possible in patients with carcinoma to transplant the growth in other parts of the body and have it live. On the other hand if carcinoma cells are transplanted from a patient to another well person the cells in all likelihood will not live.

Several years ago we had a female dog that developed carcinoma of the breast. Doctor Mann became interested and thought it would be an excellent opportunity to find out the results which would follow the transplantation of carcinomatous tissue. He made transplants in about 130 days and in no instance was he able to make the transplant live. In some of the dogs the transplant lived from two to six weeks and then disappeared. As I remember the transplants were made in various ways but in no instance did they live.

LOCAL ANESTHESIA IN KIDNEY SURGERY

By Carroll W. Allen, M.D.
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The results obtained in this field of surgery, the comparative freedom of postoperative disturbances and the facility with which these operations can be performed with a proper application of the technic, again prompts me to urge its more frequent adoption by the general surgeon.

While nitrous oxide, as administered at the present time, is the ideal anesthetic in the majority of cases, there still remains a large number affected with pulmonary, cardiac and other complications in which the giving of any general anesthetic must add additional danger. It is particularly in this class of cases that local anesthesia should have precedence. The following cases illustrate this advantage:

Mr. B., aged forty years, had been operated upon three years previously for stone in the left kidney. He did badly on the table under the anesthetic (ether) and vomited incessantly for five days following. Within a year he had similar symptoms in his right kidney but refused operation. His condition became so bad that he was later referred to me by his family physician. On examination stones were found in both kidneys with blood and pus coming from right side. Renal competence slightly below normal. Operation at Touro Infirmary, October 2, 1914, local anesthesia. Small irregular stone found fixed in renal calyx requiring bisection of the kidney. Suture of kidney and closure with drain. Convalescence without incidence. No vomiting.

Left hospital after seven days for further convalescence at home. March 12, 1915, operated under similar methods for stone on the left side. It was again necessary to bisect the kidney to locate the stone, which was of small size and found in renal pelvis. Convalescence smooth. Walked out of hospital in ten days.

Mrs. E., aged thirty-seven years. Had large pyonephrosis of the right side. Operation had previously been attempted but had been abandoned as too hazardous. Some pulmonary complication followed which left her with a chronic bronchitis. Examination of the urinary excretion showed practically nothing from the right side with the left side fairly normal. Operated at Touro Infirmary, September 29, 1919, local anesthesia. The kidney was little more than a large pus sac and had to be tapped before it could be delivered through the incision, but its removal presented no special difficulties. It was evident that the pathology had changed considerably since the first operation, for after tapping it was removed quite easily. Wound closed with drainage. Recovery uneventful. Left hospital on eleventh day.

Mrs. Y., aged sixty-five years. Bilateral renal calculi with pyonephrosis of the left side. The following is an extract of the report of Dr. Walther, who made the cystoscopic study of the case: "The right kidney urine shows a trace of albumin, a few hyaline casts, a few red blood cells, many pus cells and many staphylococci. The left kidney urine shows a trace of albumin, few hyaline casts, many red blood cells, many pus cells and many staphylococci. One c.c. of phthalein injected intravenously appeared from the right kidney catheter in six minutes and in fifteen minutes the right kidney excreted 7 per cent. of the dye. The phthalein appeared from the left kidney in ten minutes and in fifteen minutes this kidney excreted 1 per cent. Skiagraphs show bilateral calculi. Knowing that the left kidney would have to come out, I felt there was greater chance of a reflex anuria affecting the right kidney, handicapped as it was with a stone, if the left kidney was removed first; whereas if a

simple nephrotomy was done on the right side first and there was any local disturbance the left side would be able to do some work until the right side recovered. It was accordingly decided to operate on the good side first, which was done on July 6, 1920, under local anesthesia. I removed a large irregular stone completely filling the pelvis. Convalescence without incident except for a cystitis, which caused much discomfort, but which was finally controlled by irrigations and instillations. She left the hospital after fourteen days. Returned October 11 when left kidney was removed under local anesthesia.

The kidney was badly disintegrated and consisted of a series of pus sacs full of stones. There were extensive dense adhesions, with the tissue at the hilum unrecognizable in a dense fibrous mass, practically impossible to ligate. Clamps were applied and left in position for three days. Convalescence slow, largely due to a recrudescence of her cystitis, which was persistent and yielded slowly to treatment. Left hospital November 10.

I have just heard that she died about one month later from a rather sudden suppression of urine.

Mrs. B., aged sixty-five years, a thin, feeble, neurasthenic lady suffering with chronic bronchial and digestive disorders, had been seen by me one year previous, but owing to her bad general condition I had advised against operation. She now, however, insisted upon operation due to the persistence of her symptoms. Examination of kidneys showed practically no urine from the left side but much pus and some blood cells. Right side slightly below normal. Operated at Touro Infirmary August 24, 1920, local anesthesia. Left kidney and part of ureter removed. Kidney showed extensive pyonephrosis. Wound closed with drainage. Convalescence slow, owing to bad general condition and frequent diarrheal attacks. Left hospital September 6, in fairly normal condition. Have since heard that her general condition has much improved.

As I have been repeatedly requested to describe the

technic of local anesthesia in kidney surgery I take this opportunity to present it somewhat in detail.

Technic of Local Anesthesia in Kidney Operations. The patient is laid on the table in the proper position, but the table is not broken or the Lillienthal bridge raised, until the kidney is ready to be exposed, as this position if maintained too long may be uncomfortable. A skin wheal is made about the center of the proposed incision, through which a long needle fitted on a large syringe is entered. This is passed upward slowly under the skin along the proposed line of incision, injecting as the needle is advanced to the interval between the eleventh and twelfth ribs. The needle is now partly withdrawn and directed downward along the proposed line of incision beneath the skin infiltrating the entire distance down to the crest of the ilium. The needle is now directed downward from the skin surface to reach the lumbar fascia, which is recognized as the first plane of resistance in the deeper parts. The attempt should be made to reach this fascia just at the outer margin of the quadratus lumborum muscle. This is pierced by the needle at about three points, an inch or more apart, and the tissues beneath the fascia infiltrated.

Having completed the above injections the skin is now infiltrated intradermally with a small needle and syringe. This is purposely left to the last and this slight interval after the deep injections have been made allows them a slightly longer time to saturate the tissues. This skin injection can be omitted if the subcutaneous injection has been made just beneath the skin, but if this is done in stout subjects an additional injection should be made in the subcutaneous tissues at a slightly lower level. The incision is now made the entire length of the field and carried down to the lumbar fascia. The twelfth nerve is now injected high up, just under the twelfth rib. This nerve is a large trunk, larger than the other intercostals, about one-eighth of an inch in diameter, and runs obliquely downward across the field. At two inches from the spinous process of the vertebræ it lies

about one inch below the rib; from this point it follows the outer edge of the quadratus lumborum, lying in close contact to it beneath the lumbar fascia as far down as the crest of the ilium. It should be injected high up, proximal to the field.

The long needle is now passed inward through the lumbar fascia and the cellular tissue and fat around the kidney lightly infiltrated. All bleeding points are now ligated, the table broken or the bridge raised. This interval allowing time for the last made injections to diffuse. The lumbar fascia is now divided close to the edge of the quadratus lumborum; the twelfth dorsal nerve is exposed and should be protected. The finger is slipped in over the surface of the quadratus muscle toward the vertebral column and the long needle passed in alongside of it and the tissues just to the side of the bodies of the vertebræ and in front of the transverse processes are lightly infiltrated at three or four points up and down the spine. It is here that the rami communicantes, which come forward from the spinal nerves, join the sympathetic chain alongside of the vertebræ. These nerves carry sensory fibers to the abdominal plexuses. The bodies of the vertebræ are easily palpated and the structures lying on it, the aorta and the vena cava.

We now open the cellular tissue and fat around the kidney and deliver it into the wound. If the kidney is to be removed, bisected or the operation involve its hilum a light infiltration is necessary around the vessels; but this is not needed if the operation is limited to its cortex. This additional infiltration is necessary as all arteries carry sensory nerve fibers. On the renal arteries they come from the plexus on the aorta. This completes the technic, and when done in a methodical way is quite quickly executed.

We should always inject well ahead of the operation, and after doing so, stop to ligate and complete other necessary details, thus allowing time for the injections to saturate the tissues without having to lose time in waiting for this to take place. The time consumed is usually slightly longer than when operating with general anesthesia, and in simple cases

takes about three-quarters of an hour. In one of the cases cited above in which the kidney was bisected and a stone removed the patient's son, a physician, told me when through that he had timed me and we had taken fifty minutes.

The anesthetic solution is generally 0.5 per cent. of novocain with three or four drops of adrenalin to the ounce; from six to eight ounces is usually necessary. I prefer a 5 or 10 c.c. syringe which should fit the needle with a slip joint, so as to be easily removed for refilling without disturbing the needle. The needle should be of fine caliber, about four inches long, with a sharp, short, bevelled point. Once the needle has entered the skin it is not removed until all of the superficial injections have been completed, but is only partly withdrawn and redirected in different directions. This saves time and limits the number of skin punctures.

It is preferable that the patient have a light meal at the regular meal time preceding operation. About one hour before going to the operating room an opiate is given by needle, usually $\frac{1}{4}$ grain of morphin with $\frac{1}{150}$ grain of scopolamin. In nervous individuals $\frac{1}{3}$ grain of pantopon is substituted for the morphine and in elderly patients the scopolamin is omitted. It is decidedly objectionable to blindfold the patients or to plug their ears, as is sometimes done. I always prefer to talk with them during operation; this helps to divert their mind and dispels any fear. Many are slightly nervous when we start, but soon quiet down and gain confidence when they find they are not to be hurt.

The postoperative condition is in marked contrast to similar cases operated under general anesthesia. There is practically no shock, often no nausea and the patient is at once able to take draughts of water; pain is usually not felt in the wound for two or three hours following. The survival or failure of any methods advocated for practical daily use must rest entirely with the clinical results obtained and those methods which attain these ends with the least disturbance to the patient, and the least suffering must ultimately prevail over all other harsher and less agreeable methods.

AN ANALYTICAL STUDY OF FIFTY CASES OF URETERAL STRICTURE AND PYELITIS

By J. N. Baker, M.D.
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The object of this study is to point out the more common pitfalls which are likely to beset the surgeon when confronted by lesions within the abdominal cavity and to forcibly direct attention to the frequent and close relationship existing between lesions of the kidney and ureter and remote foci of infection. So constant has been this association in the study of the cases forming the basis of this report that one is almost driven to the conclusion that they stand in the relation of cause and effect.

Pathological lesions within the renal pelvis and of the ureter undoubtedly occur with greater frequency in the female than in the male, and more often on the right side than on the left. Just why this should be has not as yet been fully and satisfactorily explained. Keyes in his admirable article, "Infections of the Kidney," contributed to Cabot's *Urology*, views with favor the theory advanced by Volkow and Delitzen that the shallowness of the lumbar recess in women as compared with men, and on the right side as compared with the left, is competent to explain the preponderance of both right sided renal mobility and infection. Still another unquestioned mechanical factor is the more frequent occurrence in the female of a movable cecum and ascending colon, which, by dragging upon the kidney, materially interferes with both renal circulation and drainage. These theories, however, do not explain the very frequent bilateral involvement often seen in the more chronic forms.

The frequency with which one encounters obstructive lesions in the ureter, and the satisfactory results obtained from appropriate treatment and the establishment of adequate drainage, justify the conclusion that strictured conditions of the ureter may likewise be potent factors in the production and perpetuation of these infections whether unilateral or bilateral. Certain it is that the "mechanics" of renal infection should never be lost sight of. Any physical factor which by its presence tends to impair the normal functioning of the kidney, whether it be of circulation or drainage, should be taken into serious account and remedied if possible.

In the series now under consideration all were in females as the writer's cystoscopic work is confined exclusively to this sex. Of the 50 cases, 39 (or 78 per cent.) were unilateral, 26 (or 52 per cent.) occurring on the right side and 13 (or 26 per cent.) occurring on the left; 11 of the 50, (or 22 per cent.) were bilateral. It will thus be seen that the ratio of incidence of the right-sided lesion as compared with the left is as 2 to 1 and that of bilateral to unilateral incidence is as 1 to 4.5 approximately.

It is the right-sided lesion which furnishes the ready trap for the hasty and impulsive surgeon. If the patient be experiencing an acute attack in which the strictured area becomes inflamed and swollen, with the damming up of infectious products within the kidney pelvis, thereby producing exquisite pain, considerable temperature and a pronounced leukocytosis, the appendix will almost certainly be bottled within twelve to twenty-four hours. The mimicry here displayed is such as to mislead the most astute unless one be eternally on his guard. In this series, 7 (or 14 per cent.) had been subjected to this unnecessary ordeal, 2 of the 7 being mistakes committed by the writer himself.

Points of importance in differentiating between these two lesions are the following: (*a*) Careful microscopic examination of a catheterized specimen of urine; (*b*) absence of marked

right-sided abdominal rigidity when the lesion is retroperitoneal. The acutely inflamed appendix rarely fails to produce demonstrable rigidity in the lower right quadrant; (*c*) hyperpyrexia points to infection within the pelvis of the kidney, rarely to the appendix; (*d*) the Murphy sequence of onset of symptoms when the lesion is appendicular—that is, pain, nausea, vomiting and elevation of temperature.

In the more chronic forms of this affection, when the patient's suffering has been allowed to drag through a period of months or years, the honors of surgical immolation are divided between the appendix on the one hand and the reproductive organs on the other. Of this series, 11 (or 22 per cent.) had been operated for "chronic appendicitis" alone (exclusive of the 7, or 14 per cent., operated for "acute appendicitis"). In 6 (or 12 per cent.) the diagnosis of "chronic appendicitis" had been made and operation advised. In 9 (or 18 per cent.) the primary surgical assault had been made on the reproductive organs alone. In 3 (or 6 per cent.) two or more operations had been performed in the effort to eradicate the cause. All told, therefore, 27 (or 54 per cent.) had either been operated upon or had had operation advised as the necessary remedial measure.

These figures tally closely with the experiences of other men whose statistical material is larger. Braasch, of the Mayo Clinic, states that at least 50 per cent. of all the right-sided renal and ureteral lesions applying to this clinic for relief have previously been subjected to one or more futile operations. Hunner, of Baltimore, in his experience, finds the percentage even higher. These figures bespeak a too high percentage of error on the part of the general surgeon and present an appealing argument for the more frequent use of those agencies which have placed the diagnosis of lesions of the urinary tract within the realm of an exact science.

The second important fact revealed by this study is the consistent occurrence of one or more foci of infection somewhere within the body. The puzzling feature of most of the

experimental and scientific work done in the realm of urinary infections has been to harmonize the constant and dominating presence of the colon bacillus in these urines with the types of organisms controlling the field in the organ or organs suspected of being the originators of the mischief. Why, if a streptococcic laden tonsil be the *fons et origo* of this type of renal pathology, cannot we oftener demonstrate streptococci in the urine?

With the work of Rosenow upon the elective localization of streptococci we are all familiar. Yet he, after injecting 220 different strains of streptococci into 883 animals, found lodgment in the kidney in only 9 per cent. One of the most convincing pieces of work, bearing immediately upon focal infection and pyelonephritis, has just been completed by Bumpus and Meisser, of the Mayo Clinic. Their studies were based upon a series of cases presenting subacute lesions of the urinary tract with dental or tonsillar sepsis and colon bacilli predominating in the urine. Not only were they able to produce in the majority of the animals injected definite renal lesions from cultures taken from the teeth or tonsils; but in two of their cases showing marked exacerbation following tooth extraction, they were able to recover streptococci from the urine, which, when injected into animals, produced lesions of the urinary tract identical with those obtained from cultures of the teeth.

These experiments show conclusively that streptococci isolated from infected tonsils and teeth manifest a striking selective affinity for the urinary tract, for of 26 animals injected with the primary cultures, 24 had lesions of the kidney and 8 showed lesions in both kidney and bladder. Further, they were unable in those patients whose urine showed only colon bacilli to produce in animals any definite renal lesions by intravenous injection of cultures from this source. The ureters in some instances also showed definite hemorrhagic lesions, their walls being both inflamed and thickened.

TABLE OF CASES.

Number.	Age.	Sex.	Side involved.	Bilateral.	No years existing	Probable focus.	Pus found in urine or definite history of pyelitis.	Location of stricture above bladder.	Organisms found on culture.	Previous operations performed for relief.
1	35	F.	....	Yes	5	Tonsils	Yes	4 and 5 cm.	Colon	None.
2	53	F.	....	Yes	15	Teeth	Yes	10 and 12 cm.	R. colon L. colon	Appendectomy recommended.
3	20	F.	Right	...	2	Tonsils	Yes	3 cm.	None	Appendectomy.
4	41	F.	Left	...	22	Tonsils	Yes	9 cm.	Colon	Uterine suspension.
5	37	F.	Right	...	12	Tonsils	No	3 cm.	None	Curettement.
6	36	F.	Right	...	15	Tonsils	Yes	12 cm.	Colon	Amputation of cervix; repair to perineum.
7	20	F.	Right	...	3	Tonsils	No	3 cm.	None	Operation for appendicitis recommended.
8	37	F.	Right	...	10	Uncertain	No	15 cm.	Staphylococcus albus	None.
9	38	F.	Right	...	15	Teeth	No	10 cm.	None	Appendectomy recommended.
10	38	F.	Left	...	3	Sinusitis antrum	No	5 cm.	None	None.
11	33	F.	Right	...	9	Uncertain	Yes	15 cm.	None	Appendectomy.
12	18	F.	Right	...	2	Tonsils	No	3 cm.	None	Appendectomy.
13	34	F.	Right	...	14	Tonsils and teeth	No	7 cm.	None	Appendectomy and kidney anchored.
14	23	F.	Left	...	3	Tonsils	No	3 cm.	None	Appendectomy and ovariotomy.

15	40	F.	Right	...	12	Probably teeth	Yes	8 cm.	Colon	None.
16	46	F.	Left	...	5	Teeth	Yes	3 cm.	Colon	None.
17	34	F.	Left	...	3	Teeth	Yes	3 cm.	Staphylococcus albus	None.
18	33	F.	Right	...	14	Uncertain	Yes	3 cm.	Colon	None.
19	35	F.	Right	...	10	Teeth & tonsils	Yes	4 cm.	Colon	None.
20	20	F.	Right	...	2	Tonsils	No	4 cm.	None	None.
21	43	F.	Left	...	10	Teeth	Yes	11 cm.	Staphylococcus albus	Curettement.
22	32	F.	Right	...	10	Tonsils	Yes	4 cm.	None	None.
23	18	F.	Right	...	4	Tonsils	No	13 cm.	None	Appendectomy.
24	42	F.	.....	Yes	15	Teeth	Yes	L. 3 cm. R. 3 cm.	R. colon L. colon	Appendectomy.
25	41	F.	Right	...	10	Teeth and tonsils	No	5 cm.	None	None.
26	24	F.	.....	Yes	4	Tonsils	Yes	R. 5 cm. L. 3 cm.	L. none	Appendectomy.
27	44	F.	Right	...	12	Teeth and tonsils	Yes	5 cm.	Colon	Appendectomy.
28	22	F.	Right	...	4	Tonsils	No	5 cm.	None	Appendectomy.
29	24	F.	Right	...	1	Tonsils	No	4 cm.	None	None.
30	28	F.	.....	Yes	8	Uncertain	Yes	R. 3 cm. L. 8 cm.	Colon	Appendectomy.
31	32	F.	Right	...	11	Teeth	Yes	3 cm.	Colon	None.
32	26	F.	Left	...	17	Tonsils	Yes	3 cm.	None	Ovariotomy and appendectomy.
33	35	F.	Right	...	6	Tonsils	No	12 cm.	None	None.
34	53	F.	.....	Yes	25	Uncertain	L. pus R. none	R. 7 cm. L. 4 cm.	R. colon L. colon	Curettement.

Number.	Age.	Sex.	Side involved.	Bilateral.	No years existing	Probable focus.	Pus found in urine or definite history of pyelitis.	Location of stricture above bladder.	Organisms found on culture.	Previous operations performed for relief.
35	32	F.	.....	Yes	12	Teeth	R. pus L. pus	R. 4 cm. L. 3 cm.	R. colon L. colon	None.
36	19	F.	Right	...	6	Tonsils	Yes	3 cm.	Negative	Appendectomy advised.
37	30	F.	Right	...	10	Tonsils and teeth	Yes	4 cm.	Colon	Appendectomy.
38	60	F.	.....	Yes	15	Tonsils	Yes	R. 3 cm. L. 3 cm.	R. colon L. negative	Appendectomy, bilateral ovariotomy and hysterectomy.
39	27	F.	Left	...	8	Probably teeth	Yes	12 cm.	Colon	None.
40	49	F.	Left	...	3	Teeth	Yes	4 cm.	Colon	None.
41	52	F.	Left	...	20	Teeth	Yes	4 cm.	Colon	Right nephrectomy.
42	33	F.	Right	...	11	Frontal sinus	Yes	3 cm.	Colon	Double ovariotomy and appendectomy.
43	32	F.	Right	...	7	Probably teeth	No	4 cm.	None	Appendectomy.
44	18	F.	Left	...	1	Tonsils	No	3 cm.	Colon	None.
45	24	F.	Right	...	9	Tonsils and teeth	Yes	R. 4 cm. L. 11 cm.	Colon	Appendectomy and ovariotomy.
46	32	F.	.....	Yes	5	Tonsils	No	R. 4 cm. L. 4 cm.	None	Appendectomy for suspension of uterus.
47	23	F.	Left	...	16	Tonsils	No	3 cm.	None	None.
48	13	F.	.....	Yes	4	Tonsils	Yes	None	Colon	None.
49	35	F.	.....	Yes	12	Tonsils	No	R. 6 cm. L. 13 cm.	None	(*a*) Appendectomy. (*b*) Double ovariotomy.
50	38	F.	Left	...	4	Teeth	No	3 cm.	None	None.

In the series now under consideration the tonsil must be awarded first place; as in 21 (or 42 per cent.) this organ manifested, both by its appearance and behavior unmistakable evidence of disease. In the majority of cases there was a definite history, not of one but of many attacks of a ute tonsillitis and the tonsil was not considered blamable until judgment had been passed by a competent throat specialist.

Next in importance come the teeth: Eleven (or 22 per cent.) revealed definite evidence of one or more—sometimes several—apical abscesses. No conclusions were drawn concerning the mouth without the corroborative evidence of the *x*-ray. In 7 (or 14 per cent.) both tonsils and teeth presented definite evidence of disease, and in the tabulated report accompanying this paper the honors have been equally distributed between these organs. In 2 (or 4 per cent.) sinus infection—one frontal and one antrum—was the apparent source from which the urinary lesion sprang.

In only 9 (or 18 per cent.) was evidence lacking of a definite focus, which readily might be held responsible, and these have been classed as "uncertain." Even this small percentage could likely have been reduced had the same degree of care been exercised in a search in the earlier cases, for the probable focus of infection as was done in the later cases.

The average number of years which the trouble had persisted was eight and a quarter, the shortest being one year and the longest twenty-five. One sees at once that chronicity, due largely to a failure to grasp the underlying pathology, is an outspoken characteristic of these lesions. When diligence is observed in recording the history the beginning of the kidney lesion is often to be found faithfully reflected in one or more attacks of tonsillitis in childhood, complicated by a continued but irregular fever, back or loin pain and bladder disturbances. The age of adolescence and young womanhood confers, seemingly, a period of greater or less immunity, but quite certainly to be lighted up later during the child-bearing age. The common picture of pyelitis of pregnancy does not

originate *de novo*. The insult added to an already crippled drainage system by the changed mechanics of the pelvis brought about by the gravid uterus is quite sufficient to light up the smoldering flames, provided the primary focus be still present.

In 30 (or 60 per cent.) either pus was found in the urine at the time of renal catheterization or the history pointed to one or more definite attacks of pyelitis. The story unfolded by many of these cases as to the character, location and the behavior of their pain is as straightforward and as valuable diagnostically as is that of the duodenal ulcer or of the crippled appendix. The cases of considerable duration and with a definite history of antecedent pyelitis usually showed pus from the affected side at the time of ureteral catheterization. Those of shorter duration and with a negative pyelitis history, even though manifesting definite ureteral strictures, frequently gave negative urine and cultures.

Culturally the colon bacillus was found in 23 (or 46 per cent.); the staphylococcus albus in 3 (or 6 per cent.) and in 24 (or 48 per cent.) no growth was obtained. The appearance of the staphylococcus albus in three cases was, in all probability, due to accidental contamination at the time of collecting the urine, as this organism is short-lived and plays a very minor role in infection of the renal pelvis. In no instance was the streptococcus recovered, due possibly to the fact that no cultures were made in any of the pyelitis cases during an exacerbation.

Finally, in 49 (or 98 per cent.) an appreciable obstruction could be demonstrated at some point within the ureter above its entrance into the bladder by means of the wax bulb implanted upon the catheter. In 35 (or 70 per cent.) the obstruction was from 3 cm. to 6 cm. above the bladder opening or within the broad ligament area. In 14 (or 28 per cent.) the obstruction occurred from 9 to 12 cm. at or near the pelvic brim. The only case in the series failing to reveal ureteral obstruction was that of a child of thirteen years with bilateral pyelitis.

Conclusions. 1. The frequent occurrence of symptom-producing lesions of the urinary tract in the female demands an exact diagnostic study before resorting to surgery.

2. These lesions are largely dependent upon infections of a hematogenous origin, the primary foci of which must be diligently sought out and removed before permanency of cure can be hoped for.

3. Both clinical experience and experimental studies tend to incriminate tonsils and teeth as the chief offenders.

4. Not only are strictured conditions of the ureter of more frequent occurrence than has been generally supposed, but their presence, by mechanically impeding drainage, constitutes an important factor, which must be reckoned with in the effort to clear away subacute or chronic infections of the urinary tract.

DISCUSSION ON THE PAPERS OF DRS. ALLEN AND BAKER

Dr. Guy Leroy Hunner, Baltimore, Maryland.—I have been greatly interested in both of these papers. I think Dr. Allen has made an important contribution in emphasizing the use of local anesthesia, particularly in certain kidney cases of the type he has mentioned, those with advanced lung tuberculosis and those with bilateral renal calculi, in both of which cases we dislike to use a general anesthetic.

My experience has been limited in the use of local anesthesia for nephrectomy. I have done it in only two cases, both with advanced lung tuberculosis, and in each case the operation was most satisfactory. In the first one the kidney happened to be of the pyonephrotic type and was loose, without many pelvic attachments, and was easily removed. The patient had a little nausea while I was working on the kidney pedicle. The second case was one having tuberculous adhesions binding down the pelvic region of the kidney, and we had to use gas anesthesia for a few minutes only. In that type of case, however, intracapsular enucleation might be preferable.

I have been particularly interested in Dr. Baker's paper. All those who have tackled the problem of ureteral stricture are practically agreed as to the unanimity of results that are obtained. There are many arguments advanced against the existence and importance of ureteral stricture, but those arguments are chiefly on the part of those who will not use the simple methods necessary for the diagnosis of stricture when it is present. The arguments with which I have very little patience come from urologists, men who are passing the ureteral catheter every day and refuse to make the slight addition to their armamentarium of putting a bulb on their catheters to decide whether a patient has ureteral stricture or not. These men depend in a large measure upon roentgenograms. That is all right if they would interpret them correctly.

My experience in going into general urological clinics is to have a roentgenogram shown me with definitely dilated ureters, and the urologist has not interpreted them as such. I do not know why it is that they insist on the ureter being dilated as large as a finger before they call it dilated. Some of you have several normal ureters and have had to splice them, and such ureters are the size of a slate-pencil rather than a lead-pencil or an index finger. The average urologist relies solely on his interpretation of the *x*-ray plates, and oftentimes such men are not reading pyelograms correctly. The urologists in general today are taking the attitude of the old farmer that you have heard about who went to the circus and saw his first giraffe. He looked at the animal with great wonder, turned around, and said, "Aw, shucks! There ain't no such animal."

Dr. Baker has spoken of the relatively greater frequency of stricture of the ureter in the female than in the male. Like Dr. Baker, I operate only on women and cannot speak with authority concerning the frequency of stricture of the ureter in males, but Dr. A. I. Folsom, of Dallas, whose work is that of pure urology and who has referred to him about an equal number of men and women, tells me he finds stricture as often in the male as in the female.

I should like to touch on the point Dr. Baker made about the difficulty of reconciling the theory of focal infections in these diseases, with the fact of finding colon bacilli in practically all of these kidneys. As a matter of fact we do not have to reconcile these points. They are related only in an indirect way. I have shown that practically all strictures are found in the pelvis

just as Dr. Baker mentioned. He has found the strictures 3 or 4 cm. above the bladder, or 3 or 4 cm. below the pelvic brim. These are the areas where we have groups of lymphatic glands. The primary infection is probably first sifted out by the lymphatic glands and later gets over into the ureter and causes inflammation, infiltration and later stenosis of the ureter. At that time we get no infection of the kidney except in the exceptional cases, the fulminating pyelonephritis cases. In these cases we find the streptococcus or staphylococcus in the urine; but in the majority of cases in which we have a stricture it may be for weeks, months or years before a colon bacillus pyelitis takes place due to stasis of urine and to some unusual infection from the gastro-intestinal tract or somewhere else, the kidney having too many colon bacilli to take care of under these conditions of stasis.

Dr. Charles H. Mayo, Rochester, Minnesota.—I was much interested in Dr. Allen's paper from the standpoint of local anesthesia. I think that after all we must fit the anesthetic to the patient. There is no operation on any structure of the body, but that can be done now under local anesthesia. Even those who have talked so much about nitrous oxide and oxygen anesthesia have come around to other types of anesthesia and have gradually changed. We are living in an age in which methods are subject to change.

I was in Paris this summer to attend the meeting of the International Surgical Congress, and in visiting various hospitals I found that fully 60 per cent. of all major surgical work, brain work, abdominal work and breast work is done under local anesthesia. The French have been using local anesthesia much longer than we have in this country. I saw two resections of the stomach for carcinoma done under local anesthesia. With a long five-inch needle splanchnic injections were made. I saw Labat, who has written a book in French on local anesthesia, take this long needle, insert it and inject the solution five inches deep from the back. There was absolutely negative pressure where the abdomen was opened, and the surgeon went on with his work. I saw gall-bladder operations and abdominal operations done under local anesthesia and was very much impressed. Knowing that Dr. Labat speaks English fluently I made arrangements with him to come to our Clinic in Rochester for a year, and he is now there training men to give local, regional and paravertebral anesthesia.

I saw De Martel do an operation with rectal anesthesia for tumor of the brain in a woman. The point I want to make is: We do not need to think that a particular method is the only method, and I do not agree with Dr. Allen who has said that the next best anesthetic for the average patient is nitrous oxide and gas. It takes twice as much good training to handle nitrous oxide and gas safely as it does to use ether. I say this from an extensive experience in handling a large number of cases. Ether as it is given in cases all over this country is much safer than nitrous oxide gas in the hands of the average person who is using it.

I want to say a word about the muscle rings of changing tubular tissue whenever a tube is run into another viscus. Take the alimentary tract just above the cardia, these esophageal muscular rings are heavier; the pyloric end of the stomach has a heavy muscle ring, and then there is a heavy muscle ring at the lower ileum. There are two sphincters of the rectum. The terminal end of the ureter empties into the bladder for a considerable distance, and it must not be mistaken for a stricture because of the slight extra tension as the acorn bulb is pulled back; the muscle is a trifle heavier in its lower three inches in order to be able to force forward against greater tension than occurs in the ureter higher up, because it must force through the wall of the bladder and into all degrees of tension in a full or partly full bladder.

Nervous and hypersensitive women are more sensitive to withdrawal of the bulb; Hunner described them as strictures of the ureter, granted that stretching gives a temporary psychic effect and is as effective as stretching a lacrimal duct for watering eyes.

Dr. Thomas S. Cullen, Baltimore, Maryland.—I think the clinical picture of ureteral stricture is becoming more evident to us every day, and in any case in which there is the slightest sign of it we in Baltimore have the advantage of Dr. Hunner's opinion. In cases of discomfort in the right lower abdomen where chronic appendicitis is suspected, but where the symptoms are not characteristic, stricture of the ureter is at once considered, and if there appears to be any likelihood of the ureter being at fault it is catheterized prior to any operative procedure. I think Dr. Hunner will agree with me that in at least three-fourths of the cases that we now refer to him with signs of ureteral stricture

he finds stricture, and in a goodly number of these cases the ureter has been the sole cause of the discomfort and operation has accordingly been avoided.

Dr. F. W. Shallenberger, Atlanta, Georgia (by invitation). —I wish to say a word in regard to ureteral stricture. I have been doing a great deal in this connection, following up the work of Dr. Hunner. The importance of the ureter as a cause of pain is becoming more and more recognized, and anyone who has done very much work along the line of ureteral strictures soon realizes that a great many operations, on women especially, have been unnecessary and have given no relief of the pain from which they suffered.

The diagnosis of ureteral stricture is simple. You either have a stricture or you have not. In using the wax bulb to determine the stricture you meet some obstruction in going in, but a definite diagnosis is made on the withdrawal of the wax bulb catheter. You get this "hang," as Dr. Hunner calls it. If you put the wax bulb catheter into a normal ureter you may get slight obstruction at the lower end of the ureter, but you do not get a definite "hang" on withdrawal unless you have a stricture. It is this "hang" which is the most important point in making the diagnosis and not obstruction on introduction of the catheter. The point at which the "hang" occurs is the point usually where the patient has had some pain. At the time you get this "hang" the patient complains of an accentuation of the pain from which she has been suffering. This is usually quite characteristic and enables you to confirm the diagnosis of stricture of the ureter.

Dr. Allen (closing the discussion on his part).—There were some points brought out by Dr. Mayo which were quite interesting. In speaking of nitrous oxide and ether I did not mean that nitrous oxide is the next best anesthetic, but it is usually considered in cases of complications when administered by an expert, to be probably one of the safest anesthetics.

Regarding paravertebral anesthesia, it is quite popular on the continent, particularly in Germany and France, but we have not found it satisfactory here; and those who have used local anesthesia extensively would rather attack the region directly from within than from without or behind, because paravertebral injections are prone to a certain number of failures.

The injection has to be more or less massively made and over a wide area, and the volume of anesthetic used is so great that one hesitates to adopt any reënforcing method. In operations upon the stomach and upper abdomen one anesthetizes the area about as high as the seventh or eighth dorsal and down to perhaps the second lumbar, and it must be done on both sides. If one has studied the technic guided by the use of a skeleton he can draw a line an inch or an inch and a quarter to the side of the spinous processes, and by passing the needle down and letting it strike the transverse process of each vertebra he can feel along with the needle until he gets over the vertebra and go in about 1 cm. and make the infiltration there. What one tries to reach is the anterior branch of the spinal nerve, and through this the visceral distributions from the rami communicantes through the sympathetic chain. It is necessary to inject 10 c.c. of $\frac{1}{2}$ per cent., or 5 c.c. of 1 per cent. solution in the neighborhood to reach the nerve effectively, and in stout individuals there is a large amount of preliminary anesthesia necessary to make the paravertebral injection painless and take in five or six or more of the vertebral segments to get satisfactory anesthesia. Failure of any one may mean a failure to obtain surgical anesthesia.

What we prefer to do in all cases of stomach and gall-bladder surgery, and we do as many of these under local anesthesia as we do of kidney surgery, is to pursue the following plan. After getting into the abdominal cavity by the usual methods of anesthetizing the abdominal wall a long narrow retractor, aided by the fingers, is passed down between the viscera, searching for the posterior abdominal wall. In the case of the stomach and gall-bladder the neighborhood of the solar plexus is sought.

It is not necessary in any given case to absolutely reach the ganglion and nerve plexuses as they lie in retroperitoneal tissue. All that is necessary is to approach close enough to them so that any solution diffused in the neighborhood will readily reach them. The solution used for this purpose can be quite weak, as in common with all well-protected nerve tissue these nerves being readily affected by anesthesia solution; $\frac{1}{5}$ or $\frac{1}{4}$ per cent solution is amply sufficient.

In the event of an operation on the stomach, it may be necessary to divide the gastrocolic omentum to get up behind the stomach satisfactorily. The thing about local anesthesia within the abdominal cavity is that you have to confine your procedure

to the area injected. A limited general exploration may be carried out in the surrounding neighborhood, but anything like running your arm into the abdomen to explore distant parts cannot be done.

Dr. Baker (closing the discussion).—The point brought out by Dr. Mayo is an important one; that portion of the ureter, 1 cm. in length, which burrows obliquely through the bladder wall, constitutes one of the normal anatomic narrowings of the lumen of this duct, and a "hang" or resistance imparted by the bulb at this point should not be wrongly construed as due to a pathological narrowing caused by stricture.

This error can be obviated by careful measurements made on the catheter from the external meatus; the catheter is cautiously drawn down until a definite resistance is met. By marking this point on the catheter at the external meatus and, after extraction, measuring the distance from the meatus to the bulb, one can accurately compute the point above the bladder at which the obstruction lies; 3 cm. should be allowed for the urethral channel, 2 cm. for the distance across the base of the bladder and 1 cm. for the intravesical portion of the ureter, 6 cm. in all.

The majority—about 70 per cent.—of all ureteral strictures are located in the broad ligament area or within the last 4 or 5 cm. of the ureter; the next most frequent site is near the point at which the ureter crosses the pelvic brim—10 to 12 cm. above the bladder. The whole burden of my song is this: Pathological lesions of the ureter and of the kidney pelvis are of more frequent occurrence than is generally conceded, and it is of superlative importance to definitely eliminate these possibilities before resorting to surgery.

THE DELAYED TRANSFER OF LONG PEDICLE FLAPS IN PLASTIC SURGERY.

By V. P. Blair, M.D.
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The loss of a large cutaneous flap intended for the correction of a defect is always at least an embarrassment to the surgeon and often little short of a tragedy to the patient. The following illustrated record of disaster and near-disaster is given to emphasize one essential risk in this work and to demonstrate a means adopted to lessen the likelihood of such occurrences.

A somewhat extensive observation in the making and transplanting of cutaneous flaps for the correction of superficial defects has led to the following conclusions:

1. That about the neck and face of a man in ordinary health, regardless of age, rather long flaps can be made with little danger to their vitality provided the return circulation is obstructed neither by gravity nor kinking nor torsion of the pedicle (Fig. 2), but that in women and children the circulation is not as vigorous and equally long flaps are less likely to survive (Figs. 1, 3, 4, 5, 10).

2. That in any instance the chance of success is increased, or a longer flap can be raised, or the flap can be cut narrower and thinner, with equal chance of success if it is first completely raised and then immediately sutured back into its original bed and the transfer to the new position delayed for a period varying from six days to two weeks.

3. That if a flap does slough in its original bed the extent

of the area lost will be considerably less than if it had been immediately transplanted (Fig. 3).

4. That sloughing of an untransplanted flap is liable to be superficial without destruction of the full thickness of the skin, while a slough occurring after transfer is more likely to involve the full thickness of the flap (Fig. 4, *a* and *b*).

5. That if a flap will not survive it is a real advantage to have this fact demonstrated before removal of the scar and freshening of the edges of the defect (Figs. 3, 4, 5).

6. That provision for a possible partial loss can usually be made in the original planning of the flap (Figs. 4, 8, 9).

7. That in the transplanted position, gravity may be more favorable to venous and lymphatic drainage, but this will not always compensate for other deleterious factors essential to immediate transfer (Fig. 2).

8. That if it becomes evident that the transplanted flap is in danger of sloughing it is better to immediately place it back in its original bed; by so doing not only will time be saved, but, not improbably, a much larger part of the flap (Figs. 5–14, *c* and *d*).

9. That when a flap is to be split into two or more narrow flaps, such as to cover the eyelids or lips, or to line the nose, it is safer to delay splitting the flap until the time of transplantation or to an intermediate time rather than to do it at the time the flap is first raised (Figs. 6, 7).

10. That in a neck flap which includes a section of the clavicle for a pedicle bone graft the soft tissues will have a firmer attachment to the bone, and, I believe, the bone will be more resistant to infection if the transfer is delayed.

11. That a blood clot under a flap that has been sutured back into place may be fatal to the flap. This is to be avoided by moderate pressure of the dressings and the use of multiple drains, which are to be removed in twenty-four hours (Fig. 12, *a*).

12. That if there is to be a raw surface left exposed on the

pedicle after transplantation of the flap it will be more resistant to infection after a delayed transfer.

13. That certain complicated, time-consuming operations are advantageously divided into two sittings by this procedure.

14. That occasionally after suturing the flap back in its original bed the transplantation will of necessity be long delayed by a low-grade suture infection or an infection in the bed. Any of these occurrences is an incidence rather than a calamity and is to be guarded against by not drawing the sutures tight by removing them early, by free drainage and by ordinary cleanliness.

15. That when any part of the flap sloughs while in its original bed that part, no matter how superficial the slough, should not be transplanted (Fig. 5).

16. That another disadvantage of the method, mor apparent than real, is that it involves two operations in place of one. My own experience has been that two properly planned operations usually bring success while the single operation has too often been followed by immediate failure, necessitating a larger number of subsequent steps.

17. That even delayed transfer has not been successful in every case (Fig. 5).

The accompanying pictures were selected to bring out the various points related to the phase of the subject under consideration.

DISCUSSION

Dr. J. Shelton Horsley, Richmond, Virginia.—We are all delighted to have heard and seen the beautiful artistic work of Dr. Blair. I do not think I have seen any prettier work than that which he has shown us this morning. The principle he brought up of delayed implantation of flaps is an important one in plastic work. We have to consider two things: first of all, the patient; second, the local condition of the flap. We

a *b*

Fig. 1.—Partial slough of a short broad flap in an infant. *a*, The condition at twenty-four hours, the time of operation. Only the mesial half of the very wide right ala bordering on this oblique facial cleft was used in reconstructing the nostril, and though the soft tissues of the right half of the external nose were raised from the nasal bone they were disturbed in no other way; but in spite of this it will be seen in *b* (at right), taken seven days later, that almost all of the right ala has sloughed away.

a *b* *c*

d *e* *f*

Fig. 2.—Restoration of a palate by immediate transplantation of a neck flap. *a*, Shows the defect and the neck flap outlined; *b*, shows the neck flap sutured into the palate through an opening in the buccal fornix; *c*, shows the restored palate with the pedicle of the flap returned to the neck; *d*, *e*, and *f*, are photographs showing actual conditions. Immediate transfer of a flap of this type to a position higher than its base will usually succeed in the adult male, but in a child it will probably fail.

Fig. 3.—A sloughing flap. This figure shows a flap that was raised and sutured back into the neck with the intention of later transplanting it into a palate defect. No further attempt was made to transplant the flap but the child was saved a great deal by not having the flap placed in the mouth. A previous attempt had been made on the other side immediately to transfer a neck flap to the palate and the whole flap sloughed.

Fig. 4.—Palate repair from the neck; delayed transplantation. *a*, Shows the palate in a ten-year old child, a mass of scar resulting from the development of scarlatina the day after operation for the repair of the palate at the age of 1 year; *b*, shows the slough that occurred after raising a neck flap and suturing it in its original bed preparatory to transplanting it into the palate defect. *d*, taken thirty days later, shows that the skin was completely destroyed in only a part of the sloughed area shown in *b*. It was originally intended to have the base of this flap located near the mid-line under the skin, but after the occurrence of the slough an incision was made dividing the healthy from the damaged tissue, the latter was left in place and the incisions outlining the flap were extended across under the chin so as to bring the base on to the right cheek. An opening was made through the mucosa and buccinator muscle in the right bucco-alveolar fornix and, after freshening the edges of the palate defect, the tip of the flap was sutured in place. In *c*, the dotted line represents the position of the flap sutured into the palate. After union had occurred, the pedicle was cut and returned to the neck.

Fig. 5.—Attempted palate repair from neck flap; failure in spite of delayed transplantation. A girl of sixteen had had several previous unsuccessful attempts to repair the palate. The outlined flap which included the hair-free skin just behind the ear was liberated but left attached at both ends and sutured back in its bed. A slight superficial slough occurred near each border about the middle of the flap. The general discoloration is due to the iodine used at operation. During the period of ten days following the raising of the flap, the base of the upper pedicle was intermittently compressed each day by a spring until it was believed that the whole blood supply came through the lower pedicle. Then the upper pedicle was cut and the flap again elevated and again sutured back in its bed. Two days later the upper end of the flap was sutured into the palate defect, the resulting neck defect being filled in with a Wolfe graft. The tip of the flap was turned back and, the flap was detached from the palate, the slough removed and the pedicle replaced in the neck, as the operation had failed.

I believe the lessons to be drawn from case in Fig. 5 are that the base of the upper pedicle was made too narrow, that when any part of a flap shows the least inclination to slough this part should not be transplanted, and that two days is not long enough to determine the viability of a flap.

Fig. 6.—Sloughing flap on the arm of a child. The flap shown here was made on the arm of a twelve-year-old boy with the intention of transferring it to the upper lip and the side of the nose on a burned face. The flap was split at the time it was raised and this part sloughed. It was not used.

a

b

c

Fig. 7.—Delayed transplantation of a forehead flap for eyelid repair. *a*, Shows a child with facial burns of peculiar distribution; *b*, shows an outlined forehead flap that was cut very thin and sloughed in its distal part; *c*, shows the later implantation of the flap after splitting it so as to apply to both lids.

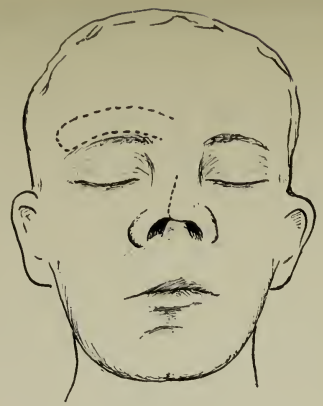
a

e

b *c* *d*

Fig. 8.—Repair of pharynx and cheek with a neck flap. Immediate transplantation failed, later transplantation was successful. Following the excision of the mucosa of the cheek, the buccinator muscle, the left tonsil, half of the vellum and part of the pharynx with a cautery for the removal of a widespread, recurrent, carcinomatous verruca, the jaws could not be separated and there was a wide defect in the cheek as shown in *a*. A flap was cut 3 inches wide and 3 inches below the left ear and the tip was taken from in front of the shoulder. The tip was immediately implanted into the defect that remained after the scar was cut from the velum, pharynx, and from between the jaws. Part of the tip of the flap sloughed and part remained attached within the mouth but not enough to permit the jaws to separate, scar having again bound them together. At a subsequent operation, the tip was cut from its attachment within the mouth, the flap lengthened by extending the pedicle upward so that the base was nearer the ear and, after removing the intra-oral and pharyngeal scars, the tip was successfully reimplanted as shown in *a*. At a later period after a new blood supply was established, the pedicle was cut at the base and unrolled, the skin edges were freed from the jaws and the cheek lined by turning the pedicle forward. The anterior end of the pedicle sloughed so that the jaws again became bound together, this time by a scar near the corner of the mouth. To correct this, a flap was taken from beside the nose, *b*, and transferred into the mouth to supplement the cheek lining, shown in *c*. Later the base of the cheek flap was cut across at the dotted line, in *d*, and the pedicle was used to line the left half of the upper lip. *e*, Shows the final cosmetic results and the ability of the patient to open his mouth. The excision of the growth was done two years before and there is no sign of a return of the disease. The successful outcome of the repair in this case was primarily dependent upon the fact that the base of the original flap was so placed that we were able to lengthen it after the tip sloughed. If the transfer of the original flap had been delayed, this would not have been necessary.

a *b* *c*



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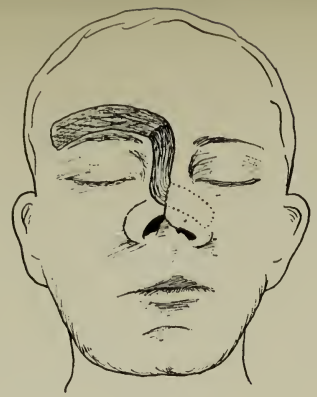


e

f

Fig. 9.—Nose with cartilages, lining, and columella destroyed by syphilis. The columella was replaced by a flap from the upper lip but this left no breathing space. The floor of each nostril was widened by turning in the flaps outlined in *b* giving the result shown in *c*. To restore the lining of the nose, the forehead flap shown outlined in *d* was cut very thin and sutured back into its bed. A week later the nose was split along the dotted line in *d* and, after cutting out the scar that bound the border of the nostril to the left nasal bone, this half of the nose was lined with the tip of the forehead flap as shown in *e*. Later the pedicle of the forehead flap was cut near its base and used to line the right side of the nose as shown in *f*. *g*, Shows the result in this case. In a case previously operated upon, immediate transplantation of the forehead flap was attempted, resulting in a partial slough of the tip and the operation had to be repeated by making an entirely new flap because no provision had been made for lengthening the flap as shown in the case illustrated in Fig. 8.

Fig. 10.—Superficial slough on tip of a flap intended for a lining of the nose. The slough part was left in its original place and, after the slough separated, so little of the thickness of the skin had been destroyed that it showed no damage. This was the second attempt to procure a flap to line this nose. The first time an immediate transfer was attempted, followed by a slough of the flap in the nose.

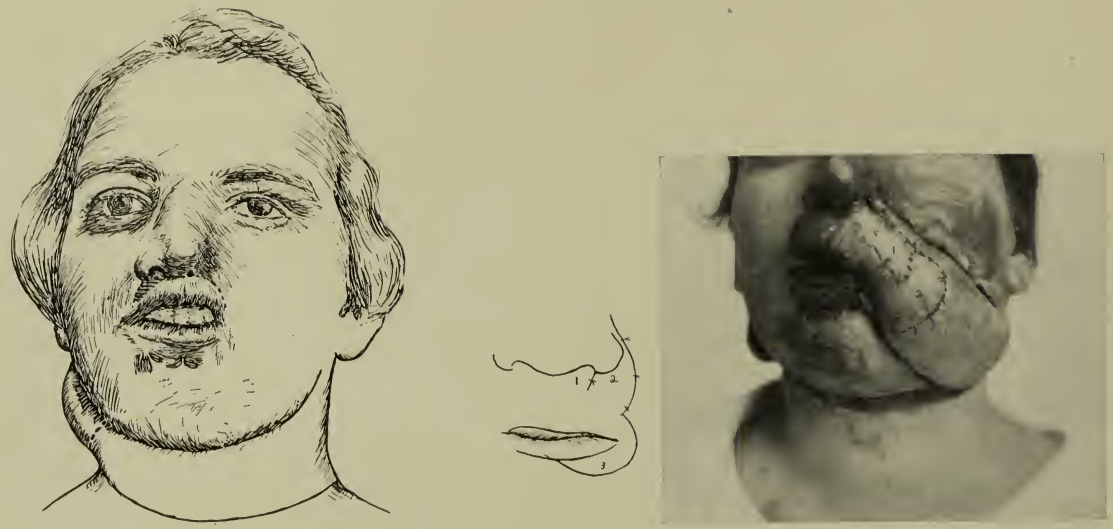
Fig. 11.—Immediate transplantation of a flap followed by sloughing. A relatively short flap is shown raised from the neck and transplanted into the cheek to relax scars on the burned face of a six-year-old child. After raising the flap its color was so good that an immediate transplantation was made in place of a delayed transfer as was first intended. Half of the flap sloughed.

a

b

c

Fig. 12.—Delayed transplantation of a long neck and chest flap to the face of a burned child. *a*, Shows the flap which has been raised but left attached at both ends, sutured back into its bed and tubed at its lower end for convenience of intermittent constriction; *d, d, d,* are rubber dam drains for immediate drainage of serum; *g*, is a gauze strip under the tubed pedicle by which it was constricted. The dotted line and shaded area on the face show the incisions into which the flap was later implanted after undermining the scar for relaxation. After a blood supply through the upper pedicle was assured, the lower pedicle was cut and the flap transferred to the face *b*. *c*, Is a photograph of the flap in place and also shows the rubber bands so placed as to take the tension off the tubed pedicle.



a *c* *b*

Fig. 13.—Delayed transfer of a submental flap to the upper lip and nose. Stout women are particularly difficult subjects on which to obtain thin, narrow flaps. *a*, Shows a submental flap cut with a double pedicle, one tubed for intermittent compression; *b*, shows the flap transplanted to the upper lip and three flaps outlined on its pedicle; flap 1 was used to line the newly constructed nostril, flap 2 made the ala and covering for the side of the nose, while flap 3 replaced a scar in the lower lip as shown in *c*. Flaps 1 and 2 were raised and sutured back into their beds at a preliminary operation, but flap 3, on account of the difficulty of previsualizing its exact position, was not raised until 1 and 2 were implanted in their new positions, when 3 was immediately transferred to its new site. Flaps 1 and 2 survived entirely without hesitation but half of flap 3 sloughed.

Fig. 14, *a*.—Repair by multiple flaps with delayed transplantation. Photograph showing the condition immediately after the destruction of a large carcinoma of slight malignancy which had been indolent for fifteen years but became active following the use of irritants and radiation. It was removed with the chisel and cautery.

Fig. 14, *i*.—Shows the result to date ready for the finer work about the eye socket for the wearing of an artificial eye, a cartilaginous graft to restore the malar eminence, a Wolfe graft in the forehead, and restoration of the right angle of the mouth.

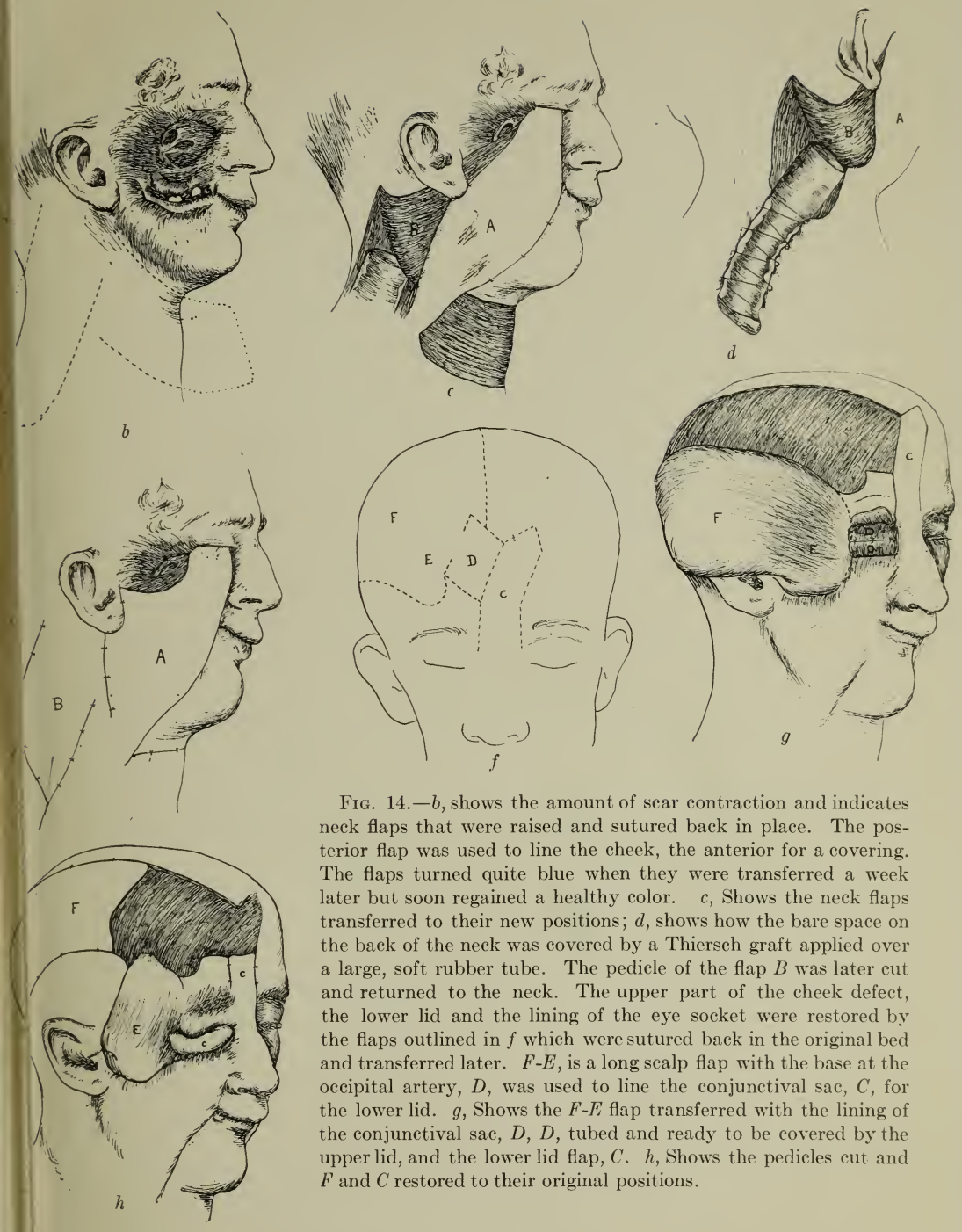
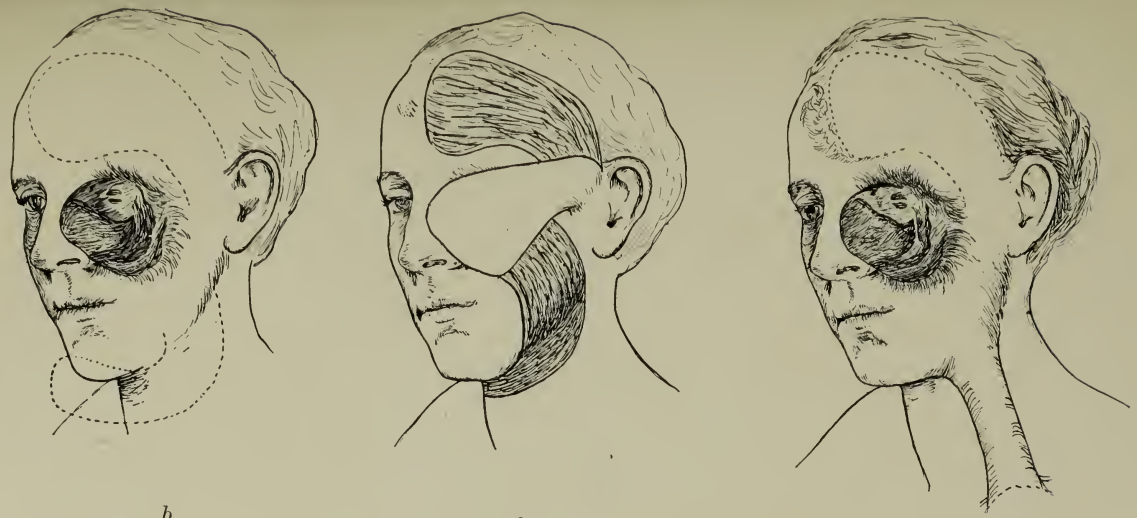


Fig. 14.—*b*, shows the amount of scar contraction and indicates neck flaps that were raised and sutured back in place. The posterior flap was used to line the cheek, the anterior for a covering. The flaps turned quite blue when they were transferred a week later but soon regained a healthy color. *c*, Shows the neck flaps transferred to their new positions; *d*, shows how the bare space on the back of the neck was covered by a Thiersch graft applied over a large, soft rubber tube. The pedicle of the flap *B* was later cut and returned to the neck. The upper part of the cheek defect, the lower lid and the lining of the eye socket were restored by the flaps outlined in *f* which were sutured back in the original bed and transferred later. *F-E*, is a long scalp flap with the base at the occipital artery, *D*, was used to line the conjunctival sac, *C*, for the lower lid. *g*, Shows the *F-E* flap transferred with the lining of the conjunctival sac, *D*, *D*, tubed and ready to be covered by the upper lid, and the lower lid flap, *C*. *h*, Shows the pedicles cut and *F* and *C* restored to their original positions.

a

e



b *c* *d*

Fig. 15.—Failure to close cheek-orbit defect by immediate transplantation of a forehead and submental flap. Success by a later delayed transplantation. *a*, Shows the condition after removing a carcinoma from the cheek and orbit with cautery and chisel. The nasal septum and ethmoid cells show in the bottom of the wound. This growth had remained small and indolent until irritated into activity by the use of a cancer paste. *b*, Shows the condition after scarring had occurred. The dotted line illustrate two flaps that were raised to fill the defect, the upper as an outer covering, the lower as a lining. The upper flap has the temporal artery and vein in its pedicle and this is usually considered safe for immediate transfer. The lower flap being brought to a position above its base is less likely to be embarrassed by impeded blood return. Immediate transplantation was done, shown in *c*, but the next day the blueness of the forehead flap strongly suggested the advisability of removing all sutures and restoring it to its original position to save as much of it as possible. The neck flap was tubed and attached to a small flap turned from the chest, shown in *d*. About 2 cm. of forehead flap was lost by slough. At a later period, repair was made with delayed transplantation of the remaining part of the forehead flap and tubed neck flap. *e*, Shows the healed condition ready for making a socket to carry an artificial eye.

a *b* *c*

Fig. 16.—Restoration of an eye socket and eyelids. *a*, shows a soldier in whom a piece of shell passed through the malar bone and outer wall of the orbit, through the orbit into the nose, destroying everything but the outer skin of the upper lid and leaving a large communication between the orbit and the nasal fossa. A posterior wall was given to the conjunctival sac and the communication between the orbit and the nose was closed by a flap taken from the forehead. The upper lid was made to do duty for both lids and a lining for the lids, as well as a flap for the repair of a nasal defect, was obtained from the forehead by delayed transplantation. *b*, Shows the flaps in place, the pedicles not yet cut; *c*, shows the glass eye in place but the nose not finished.

a *b* *c* *d*

Fig. 17.—Reconstruction of an ear. *a*, Shows what remained of an ear after an automobile accident, also three flaps that were raised and sutured back into their beds to be later draped over a cartilaginous implant from the fifth costal cartilage. The long neck flap sloughed at its tip while in its original bed. *b*, Represents an intermediate stage; *c* and *d*, show the present condition and a year will elapse before final adjustments are made.

must remember, as Dr. Blair pointed out, that certain patients stand the transplantation of a flap which would be a complete failure in others. While the immediate blood supply in young children may not be satisfactory the recuperative power is greater and collateral circulation is established quickly.

The wonderful plastic surgery done on young men during the war, who were ideal subjects for this work, cannot be done in people on whom we operate for cancer. Cancer occurs at the age of forty and over and vascularization of the flap is interfered with by age. A soldier of twenty years may be successfully repaired, whereas the same thing attempted in a man of sixty would be a complete failure.

I should like to mention the case of a patient who had a basal-cell carcinoma for twelve years which had eaten away the upper lip and alveolar process. We did a tracheotomy and gave ether through the tracheotomy wound; packed off the pharynx with wet gauze and with a Percy cautery burnt away the soft parts. The bone we cut away with an electric saw, using the Percy cautery again. There is the same chance for basal-cell cancers to spread into the glands of the neck, as the spinal-cell type, and yet they do not metastasize. I think it is important to get the flap in place as nearly as possible, because the tissue at a distance beyond the origin of the basal-cell carcinoma seems to have a certain immunity and may prevent recurrence. At the time of transplantation of the flap we make a long pedicle and tube it. That is done in a series of different operations. I cannot emphasize too much the principle of making use of such a flap and pedicle and developing the circulation in the pedicle by cutting it away a little at a time at intervals of a few days from the pedicle down, so that the last point serves as a tip. When it is then transferred no part of it dies.

Dr. A. J. Ochsner, Chicago, Illinois.—Just a word about two practical points that are worth bearing in mind. The principle of repeated sections for a flap which Dr. Horsley has given us is tremendously important. I have found that in making a flap and suturing it in place and dressing it you are liable to make pressure which will interfere with the circulation. If you place a wire basket over it, and apply the dressing on the outside of the wire basket, there is no pressure whatever, and the flap will get strong and suitable for use which would otherwise not have enough circulation and might slough off. When the

sutures are in place we make use of a little trick my brother (Dr. Edward H. Ochsner) introduced years ago of not putting on a dressing at all but painting the suture line with tincture of benzoin which has been thickened by evaporation, so that it makes a sticky, tarry kind of substance that will protect the suture line against infection. It makes a perfectly smooth line of suture without stitch marks. The work that Dr. Blair has shown us is wonderfully interesting and instructive.

Dr. James E. Thompson, Galveston, Texas.—I rise to pay my tribute to the excellent work of Dr. Blair in the field of plastic and reconstructive surgery, of which he is a master. He was kind enough to take me around with him last summer and I spent a few days seeing a class of surgery that was a revelation to me for its ingenuity and thoroughness. Like an architect, he plans his work very carefully before doing an operation; everything is arranged on a definite scale, models of the area are always made, and from these the steps of the operation are carefully planned. I wish Dr. Blair would tell us in some detail his method of handling the cartilaginous transplants which he uses to keep the nasal flaps in place. It seems to me that this is the most remarkable part of the whole operation. It is an easy matter to transplant flaps if one is careful, but it is a very difficult matter to keep those flaps from shrinking. The majority of us have had experience of noses fashioned by the Indian or Tagliacotian method, and when the work was finished it was not a pleasant thing to look at. We were never proud of it.

Dr. Charles H. Mayo, Rochester, Minnesota.—This is a wonderful exhibition of plastic work and I have nothing in particular to add to what has been said, except to bring out one or two points that occurred to me in connection with the class of cases under discussion.

We find a few people who come in with a dry skull having lost the complete scalp area so that we cannot graft onto it. We dislike to put a solid flap over it. If we drill through the outer table of the skull down to the diploë, in one week a bunch of mushroom granulations will be seen coming up through the many holes and the area will be covered with granulation and grafting may be done at once.

I have seen patients come in (I had cases of this kind myself years ago) who had had flaps turned in with the hair growing

in the mouth, having lost from disease or injury a large part of the cheek, and especially the mucous membrane that contracts, so that it holds the jaws together. I got the idea from Bernays years ago, that if the side of the tongue is split and sewed above and below to the opening a raw surface with a rich blood supply is obtained. This can be done through the hole, and after it has become attached one-third of an inch is split off the tongue within the mouth; this will open it up and give two-thirds of an inch of mucous lining, which will stretch out. It saves trouble in grafting hair-covered surfaces in the mouth. It does not remove enough of the tongue to prevent speaking.

Dr. C. E. Caldwell, Cincinnati, Ohio.—There has been under my care for some time a boy who was run over by a street car. The tarsal bones were all smashed; the foot was entirely devoid of skin both on the plantar and tarsal aspects. I am anxious to save his foot. He has been under my care for a month. Finally, there came a time when I thought a Thiersch graft would be possible. The granulations with the use of the electric lamp were very much improved. They were rather exuberant. I did Thiersch grafting over the foot, and much to my dismay the next day I found the whole area covered with pus and the dressings were saturated with pus. The grafts were carefully removed and the electric lamp put over the foot, and I was gratified the next day to find that suppuration had apparently all disappeared. The grafts had settled down and there was every prospect of their taking. I might mention the possibility of the use of the electric lamp in improving nutrition of flaps as well as settling down and causing adhesions of Thiersch grafts.

Dr. Carroll W. Allen, New Orleans, Louisiana.—We all know the tremendous amount of untiring care and attention necessary to do this plastic work successfully, and Dr. Blair is to be complimented on the wonderful success he has achieved in this work. I should like to ask Dr. Blair what satisfaction he has found from transplanting grafts. In such extensive work as he has done he must have strong grafts. We have found that where we had an area to cover it was desirable to transplant a graft from the abdomen, avoiding so many extensive grafts about the neck on which a large strip rested. One transplant is taken from the arm and another from the abdomen, treating the pedicle graft until we have got sufficient blood supply to

accomplish our purpose. The arm is then lifted up, the pedicle is cut for at least six or eight inches, the hand put on the head and the free end is stitched in one edge of the wound and then cut loose from the arm and swung around. Dr. Blair has not used this method, perhaps, and there is some good reason why he has not done so. I should like to have him say something about it in his closing remarks.

Dr. W. P. Carr, Washington, D. C.—I want to say that Dr. Blair helped me out of a hole in a considerate way several years ago. I had made two or three noses, by the Indian method, and one man for whom I made such a nose was very proud of it; but I was not. I asked Dr. Blair the best method, and following his instructions I raised a flap from the boy's left arm, took a piece of rib cartilage and built up an excellent nose on the arm. About ten days afterward, with the arm held across the forehead in a plaster cast, it was stitched in place on the face. Ten days later the flap was cut loose from the arm.

Dr. J. M. T. Finney, Baltimore, Maryland.—I want to bear testimony to the splendid work done by Dr. Blair and his associates in France. In my opinion the work done by the maxillofacial division in France, of which Dr. Blair was the head, was as good as that in any other medical department of the army. I am sorry I did not hear all of Dr. Blair's paper. There is one point Dr. Allen referred to concerning which I wish to say a word, and that is the question of transplantation of the flap from an intermediate host, the intermediate host being the arm. So far as I know, I was the first to perform that operation, about eighteen years ago, and I have not been able to find any record of anyone having preceded me. For one reason or another, chiefly scar tissue from extensive burns, I could not get satisfactory material for a nose in the neighborhood, so I took my flap from the abdomen. The man had some scars on his arm and it was extremely hairy, so I felt I could not get a satisfactory flap there. Accordingly I took a flap from the abdomen, attached it to the arm, and then kept it there until the blood supply was in good shape, then cut it loose, turned it up, Thiersch-grafted it on the surfaces and left it until it was in good shape; then brought it up and put it in place, and made quite a satisfactory nose out of it. Sometime afterward I was going along the street when a garbage cart passed me

and I heard someone call my name. It was the driver of the garbage cart who jumped down to the ground ran up to me and told me who he was, saying, "I want to show you something," and proceeded to blow his nose very vigorously, and with evident pride and satisfaction said he could blow it just as well as anybody.

Dr. Willard Bartlett, St. Louis, Missouri.—I cannot let this discussion close without saying a word. There has been one factor in the success attained by Dr. Blair which seems to have been overlooked in this discussion. A few of you who do this work know what it is. I happen to have an office adjoining Dr. Blair and work in an adjoining operating room, hence I am close to him and see much of his work. His work has been made possible by his fine quality of patience and perseverance, kindliness and courtesy, brought to bear on this class of patients; and these poor unfortunate sufferers in coming to him week after week, month after month, and year after year, have been inspired by him until he has accomplished what you have seen.

Dr. Blair (closing the discussion).—I am really embarrassed by your kind remarks and by the manner in which you have received my efforts. I would answer one or two points that have been raised in the discussion, one of which is the building of congested flaps, a point brought out by Dr. Mayo. We have added 2 per cent. benzoate of soda which keeps up the flap for twenty-four hours. The other is the control of the burnt bone. We burn the frontal bone and then get rid of the slough.

I cannot say very much about the transplantation of cartilage, but if you take out cartilage with ordinary cleanliness and bury it in live tissue with ordinary surgical care and do not allow blood-clots to get around it, in 98 cases out of 100 it will heal. After you have used it cut it so as not to leave perichondrium on one side and no perichondrium on the other. It will not shape itself.

In these flaps the main thing is to avoid getting any blood-clots under the flap. I have come to the conclusion that there is a biological relation between a blood-clot and the blood-vessels; that we lose flaps from a blood-clot that is not due to pressure. There must be some ferment that acts on the tissues, and in order to avoid that we use drainage and pressure on the flaps, and very often use a moist dressing so as not to run any

risk of having any blood under the flap. The most pernicious thing that can happen to us is to get a blood-clot under these big flaps.

In regard to Dr. Allen's question of transplanted grafts, I do not know why, but I have never used them. By using a flap such as I have described there are no scars left about the face. I have always felt it was less certain, but there is another reason that appeals to me. About the face, the closer you can get the flap from the area to be implanted the more natural the skin appears. Abdominal skin or skin of the chest has a peculiar white appearance. Probably the method Dr. Allen mentioned is as good as the one I have been using. If we work long on these cases we can hide the scars so that they do not show if we make them in the right direction.

PRIMARY CLOSURE OF THE URETER AND RENAL PELVIS AFTER NEPHROLITHOTOMY

By Le Grand Guerry, M.D.
Columbia, S. C.

My attention was first forcefully directed to the question under consideration by a paper in the Louisville monthly *Journal of Medicine and Surgery* by Abell. The paper was published some time in 1907 and demonstrated conclusively, to my way of thinking, that primary closure of the ureter and renal pelvis, when removing stones, was surely the operation of choice in properly selected cases; notice, please, the expression, properly selected cases. Unless this qualifying phrase is borne in mind, confusion as to our position will certainly arise.

Urologists, by greatly improved methods of technic and equally improved instruments, are able to remove the majority of stones from the lower end of the ureter without an open operation. Certainly, within reasonable limits, this method should be given a fair trial.

We must also remember that a large percentage of all stones in the ureter are passed voluntarily by the patient without any operative aid, and this paper concerns itself solely with the group of cases in which, for one reason or another, operation is deemed best.

In a very extensive review of the literature on this question, during the last ten years, it was quite surprising to find how frequently and how very successfully the method of primary closure has been and is now practiced. For example, we find

Israel, Albarran, Jeanbrau, Tuffier, Cabot, Crile, Young, Mayo, Judd, Murphy, Kelly and many others practice primary closure.

We can think of no reason why, when the individual case is carefully studied, the ureter should not be closed immediately. Of course, there are cases in which it would be bad surgery to attempt immediate suture, the point being that the grounds for closing in one case and not closing in another case are fairly obvious and easy to ascertain.

Judd, in a personal communication, says: "I feel confident that I have closed the ureter in 50 cases and have never known any difficulty to arise from it. In a few instances there was drainage of urine in spite of closure, although in a large percentage the wound has healed practically by first intention."

The ureter is a patent tube with dependent drainage naturally all of the way from kidney to bladder, the very best possible kind of drainage, and the simple presence of a stone does not constitute, within itself, any sufficient reason for drainage. Take, for example, a perforating wound of the intestine; we know that such a wound is infected, and yet, while we may drain the abdominal cavity, one would hardly attempt to drain from the site of each individual perforation.

Given then a stone in the lower ureter, all reasonable efforts should be made to remove the stone without open operation. There are, however, fairly definite and clear limitations to the amount of effort which should be made to remove the stone through the cystoscope.

In a paper by Judd, read before the Southern Surgical Association, December, 1919, and published in the ANNALS OF SURGERY, February, 1920, p. 129, he gives the following contraindications by Braasch as to efforts to dislodge stones (1) A stone 2 cm. or more in diameter. (2) Ossification with continuous obstruction. (3) Acute renal iufection. (4) The patient's intolerance to cystoscopic manipulation. (5) Anatomic deformity.

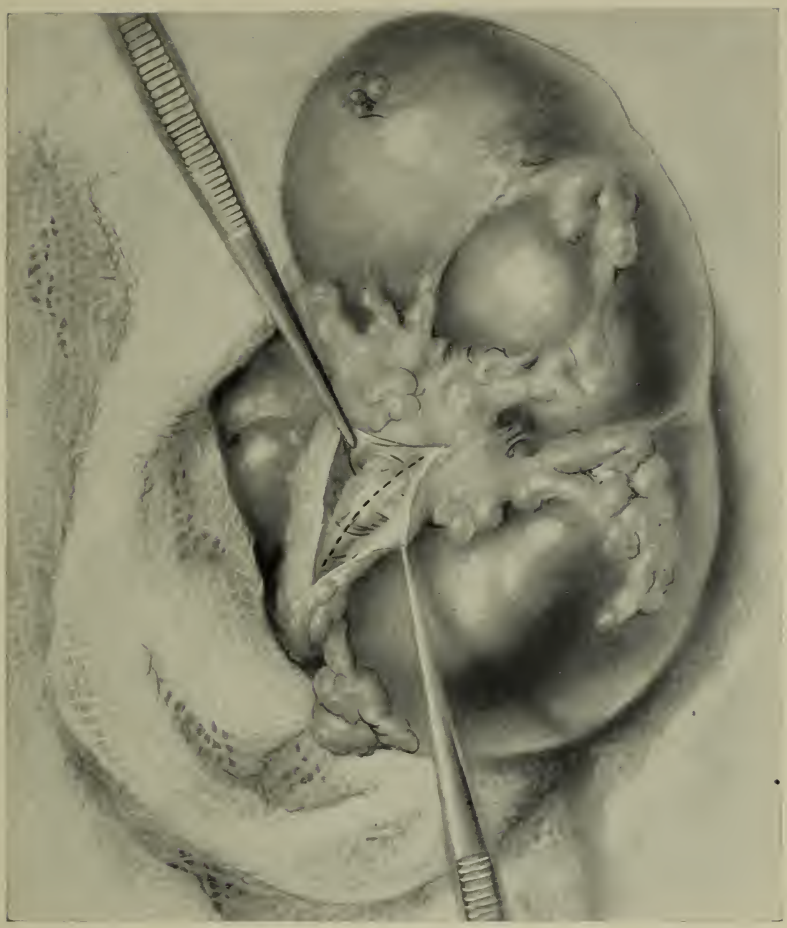


Fig. 1.—Shows kidney exposed, incision through the capsule and muscular layer, down to mucous membrane, the dotted line showing the incision to be made through the mucous layer to stone.

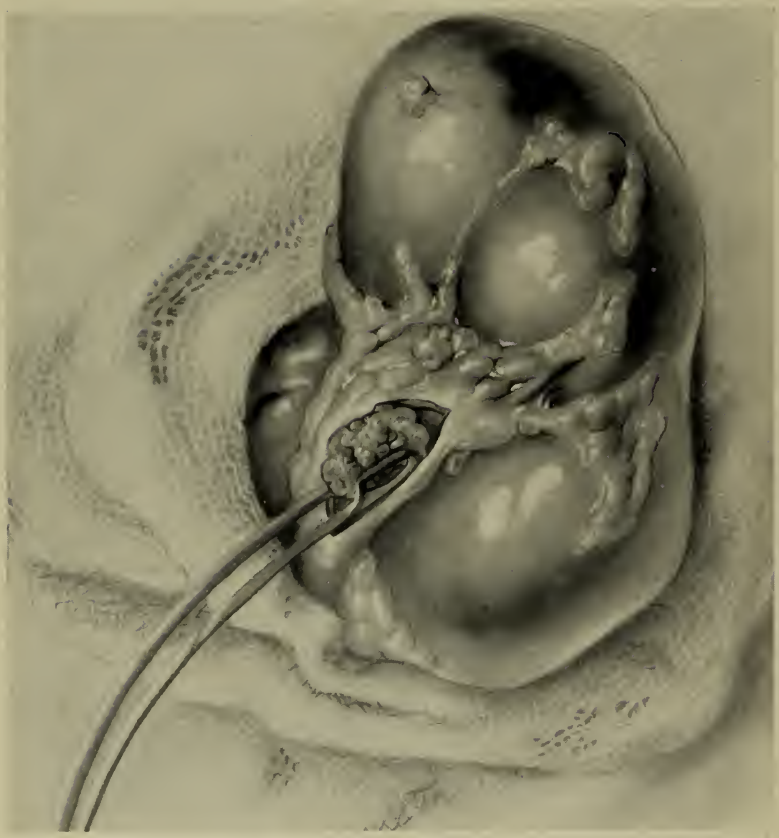


Fig. 2.—Shows the stone exposed and being extracted with long forceps, especially designed for this purpose.

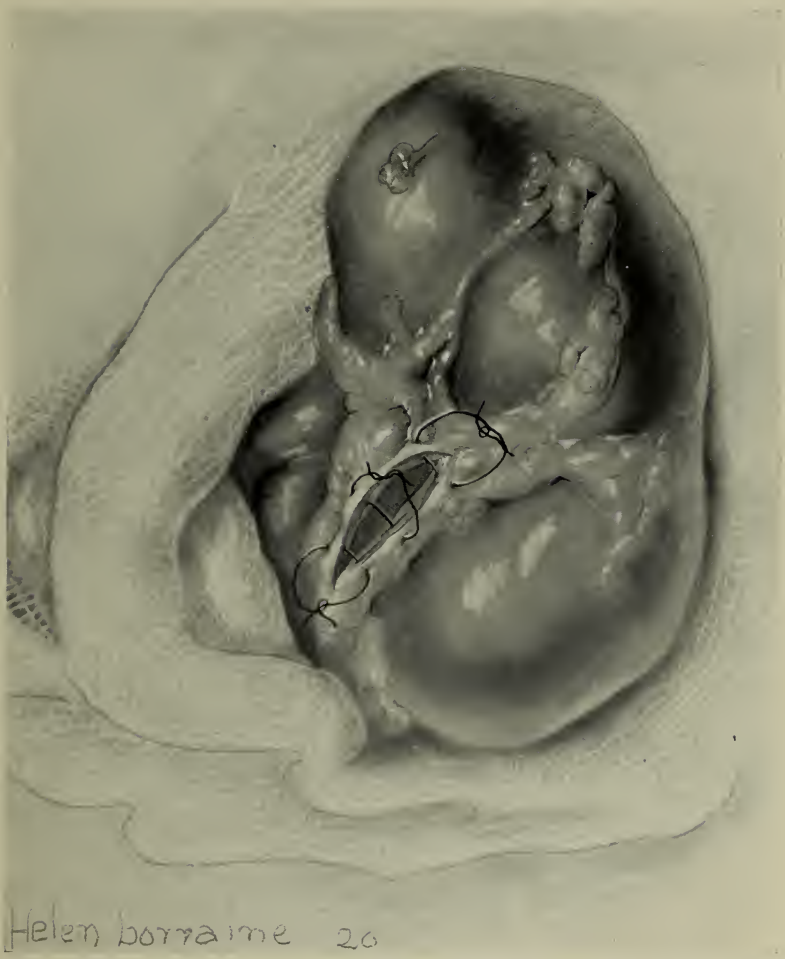


Fig. 3.—Shows the stone extracted, interrupted sutures placed and ready to be tied. Note, particularly, that these sutures do not include the mucous membrane.

Fig. 4.—Shows complete closure of incision in the pelvis. It also illustrates method of drainage without putting the drain to suture line. This plan may be adopted in certain cases in which you are willing to close primarily but would feel safer in using drain.

Fig. 5.—Shows field of operation for exposure of ureteral stone. The ureter has been exposed and held well into position in the field of operation, by two gauze tips, which serve admirably as retractors. Attention is particularly directed here, as in Fig. 1, to proper placing of suture, the fascia capsule and the muscular layer being included in the stitch, but not the mucous membrane.

If the renal infection is severe, intra-ureteral methods should not be attempted, and operation should be undertaken with the idea that it may be necessary to remove the kidney. These contraindications, while they are known to all of you, have added emphasis by the weight of this authority's sanction.

One must ever bear in mind what may happen from the continuous pressure exerted on the kidney by obstruction of the ureter, and that it is quite possible to have from this cause a permanent hydronephrosis or pyelonephrosis.

Face to face then with a given case, in which the open operation has been decided on, there are four primary reasons, the presence of any one of which constitutes sufficient reason for drainage as against primary closure: (1) a stricture of the ureter of such calibre and density as seriously to encroach upon the size of the ureter. In my experience, however, this is a very rare condition and at the present time, among urologists, is a question of lively debate. (2) The presence of extensive infection. This condition constitutes a real contraindication and is one which we do meet with occasionally. (3) Inaccessibility of the field of operation. Unless the field of operation can be rendered accessible and brought within ready control of the surgeon, it is quite difficult, if not impossible at times, to practice immediate closure. (4) At times the patient's condition may be so serious as to make inadvisable anything but the very minimum of manipulation. Personally, I have had one case in which the patient was in coma from obstruction to both ureters by stones. The stones were removed under local anesthesia; no suture of ureter was attempted; drains were placed to site of each operative field, and the patient died within thirty-six hours in uremic coma.

Such, then, and very briefly, are the reasons for drainage and non-closure; the same grounds apply with equal force to stones in the renal pelvis.

Conversely, then, in the absence of the above stated con-

traindications, our position is: that the ureter and renal pelvis should be closed primarily.

One will find, I believe, when fairly considered, that primary closure of the ureter and renal pelvis, without drainage, is a safe, sane and sound surgical practice, thoroughly consistent with the underlying principles of pathology.

Those who do not subscribe to the position of primary closure maintain that the mortality is just as low, and that the patients will recover just as well as if suturing was immediate, and this, in a very real sense, is quite true. We insist, however, with all of the emphasis at our command, that convalescence is shortened, the mortality rate is just as low. When the question, of the patients comfort is considered, there is a very great difference, don't you think, between the patient, on the one hand, with a perfectly dry, comfortable wound, and, on the other hand, a case lying in bed with a cold urine-soaked dressing, lasting anywhere from one to six weeks, the mortality rate in the primary closure being just as low as in the cases which are drained.

In all of this discussion we must remember that the open operation for removal of ureteral and kidney stones has an exceedingly low mortality rate and the very best end-results.

So much for the argument. Now for the facts based on our personal experience; for after all, we are not nearly so much interested in maintaining a certain position as we are in adding our personal experience to the primary closure side of the question. The facts are as follows: We have practiced primary closure in a series of 19 cases, not a very large series, still quite sufficient to be suggestive. Of the 19 cases, 11 were men and 8 were women. Twelve times we have closed the ureter and seven times the renal pelvis. Of the 12 cases in which the ureter was primarily closed, there was 1 case in which the sutures came out, and the ureter leaked just as much and just as long as if it had never been sutured, the basic fault here being one of surgical judgment rather than one of method, for we did violence to the rule of reason,

as pointed out in contraindications 2 and 3. The patient was a very stout male in which there was marked infection around the stone, and the field of operation was so inaccessible as to make closure very difficult.

Good judgment in this case would have dictated not closure but drainage. In one other case in this group there was escape for four or five days of a very small amount of urine, about 20 per cent. of what would have escaped had closure not been made.

We have, then, in the group of 12 ureteral cases, one complete failure, one 20 per cent. failure, and 10 cases in which the wound healed by complete primary union. Surely a result worth while and pregnant with food for thought.

In the group of stones in the renal pelvis there are 8 cases, 6 of these healed by complete primary union, and 2 cases, while they showed some leaking, were a marked improvement over the method of non-suture, since both of them leaked very little and closed within a week.

The ureter should be opened parallel to its long axis; every effort must be made to preserve the connective-tissue capsule of the ureter and the sutures so introduced as never to include the mucous membrane. The connective-tissue capsule and its use and preservation is the most essential element in success.

The method of technic and the things to be considered in a purely operative way are best shown in the illustrations.

Since writing the above, we have had 2 more cases of stone in the ureter, in which we have been able to practice primary closure after removal of stone, without drainage, and in both cases we have had perfect primary union. The addition of these 2 cases makes our total cases number 21. The figures show 14 cases of ureteral stone with twelve successful primary closures; one complete failure, and one 20 per cent. failure. If the points about the proper use of the connective tissue and fatty capsule of the kidney and ureter, in making the closure, are borne in mind, the results will be uniformly

good; it is also vitally necessary not to include in the suture the mucous membrane. It is very remarkable what an extensive injury to pelvis of the kidney can be closed immediately with perfect results, when the fatty capsule is used to reinforce the suture line.

Our rule is not to drain these cases unless it is clearly indicated.

FURTHER EXPERIENCE IN OPERATING FOR BONY ANKYLOSIS OF THE JAW: END-RESULTS

By W. P. Carr, M.D.
Washington, D. C.

In 1916 I reported to this Association three operations for complete bony ankylosis of the jaw. Since then I have operated upon three more, and the results have been so good, as well as the end-results in those reported four years ago, that I feel that I should put them on record. Particularly so because the impression seems still to exist that these cases are hopeless. At least five of my patients had been told by surgeons of considerable experience that nothing could be done. The fact that the operation is one of the most satisfactory in surgery should now be generally known, for the condition is not extremely rare and many patients are still going without relief because they have been told it was impossible.

The operation, while not really difficult, should not be lightly undertaken by those who have not had considerable experience with bone surgery and who have not made a careful study of the subject and of the individuals upon whom they are to operate; for the mechanical difficulties are greater than would appear on the surface, and many surgeons, excellent in other lines of work, would find themselves puzzled or even nonplussed when operating for the first time on bony ankylosis of the jaw.

There are numerous important structures in close prox-

imity to the field of operation, among which may be mentioned the parotid gland; Stenson's duct; the facial nerve; temporal, internal maxillary and carotid arteries. The depth of the ramus of the jaw, its width, thickness and hardness, and the entire absence of any demarcation between the jaw and the base of the skull, as well as the obliteration of other landmarks, will be a surprise to anyone operating for the first time (Fig. 1).

However, by using the instruments and method devised by Dr. J. B. Murphy and a suitable drill for cutting the bone the operation can be done with comparative ease and with safety. The Murphy operation and instruments have been well described by Kreuscher in the *Interstate Medical Journal* for October, 1916, and I shall not describe it here; but my further experience has taught me some accidents that are prone to occur and the way to avoid them, and I wish to put them on record for the benefit of others.

1. The temporal artery can be felt and located and the vertical incision made just anterior to it.

2. The horizontal arm of the incision may be made along the lower border of the zygoma instead of the upper border, as recommended by Murphy, and still be above and parallel to the main temporofacial branches of the seventh nerve, may be carried down to the bone with one sweep of the knife. No important structure will be cut.

3. To get one's bearings, make a careful dissection at the anterior end of the horizontal limb of the incision, drawing down the wound until the anterior border of the ramus can be felt and freed sufficiently to get a Murphy retractor under it (Fig. 2).

4. The parotid gland in all my cases projected over the ramus almost or quite to its midline, and can hardly be distinguished from the fat and connective tissue lying in that region. In my first four operations I injured or cut into it three times, with a salivary fistula as the result. Although these fistulas all healed spontaneously in from

three to eight weeks they were very annoying for a time and necessitated frequent redressings.

This accident may be almost certainly avoided if the operation is begun as recommended above and the subsequent dissection made by lifting up all tissue over the bone *en masse,* keeping close against the periosteum until the posterior border of the ramus is reached, the only incision through these tissues being a deepening of the original skin incision over the lower border of the zygoma and well above any important structure. The second Murphy retractor may then be inserted under the posterior edge of the ramus until it meets the first one behind the center of the bone (Fig. 2).

5. The bone is then found to be completely isolated in the region to be divided, and by boring a chain of five-eighth-inch holes through it with my cranial drill and connecting them with a gouge chisel, it is easily divided as shown in the dotted lines in Fig. 1.

The bone should be gouged out without hammering, and this can be easily done if the holes are bored close together. This can be done more easily and more quickly than division with a Gigli or other saw and allows a shaping of the bone, as indicated by the dotted lines in Fig. 1. It also takes out a thicker section of bone than a simple saw cut, and I believe this is a good thing in preventing pressure on tissue interposed between the cut ends. I have always opposed the use of a chisel and mallet upon the skull, particularly the base of the skull, near the mastoid and maxillary articulation. We all know how easily one may be "knocked out" by a slight blow on the chin, and I have seen cases of severe and even fatal shock following a vigorous use of the mallet and chisel that I believe were due to this cause.

By use of the Murphy incision and the careful dissection above recommended the facial nerve will not be injured and bleeding avoided as well as the danger of injury to the parotid or Stenson's duct.

In most cases in which the affection is one-sided the mouth will open readily after division of the bone even when the case is of long standing. In some, however, particularly where both sides have been affected, the masseter, pterygoids and other muscles have become so contracted that even with considerable force the teeth cannot be separated more than one-half or three-fourths of an inch. Great care should be observed in prying open the mouth in such cases, as the teeth, probably from long disuse, have a very slight hold in the jaw and are very easily shelled out like grains of corn from the cob. It is better to hold the head firmly and depress the chin until a mouth gag can be inserted between solid molars rather than attempt to pry open with any instrument between the front teeth, or, better still, to depend upon expansion screws to be used later between molar teeth.

I do not favor the interposition of any extraneous substance between the divided bones, although I know that Baer, of Baltimore, has had excellent results in this way. If a rather wide section of bone (five-eighths of an inch) is removed and the articular end shaped to a rounded point I do not believe this is necessary. The greatest danger of recurrence would seem to be from callus forming and attaching the anterior border of the ramus to the zygoma, and I believe this is avoided by cutting out more bone anteriorly. This has been proved, I think, by the end-results in my first three cases where nothing was interposed. However in doing the Murphy operation it is so easy to turn down a flap of temporal fascia that I favor it as an extra precaution and have done it in the last three cases.

In conclusion, I would say that the results in my first three cases, after a period of four to six years, are all that could be desired. They all have been recently heard from and are able to separate the front teeth an inch or more, eat without difficulty and are highly pleased. In the last three there were no accidents and the results so far are very satisfactory. A brief record of all my cases is appended.

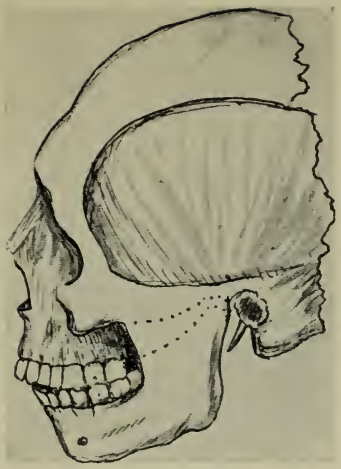


Fig. 1—Shows the solid ankylosis and total lack of any line of demarcation between jaw and skull found in all my cases. Dotted lines show the bone to be cut away, leaving a rounded point for articulation.

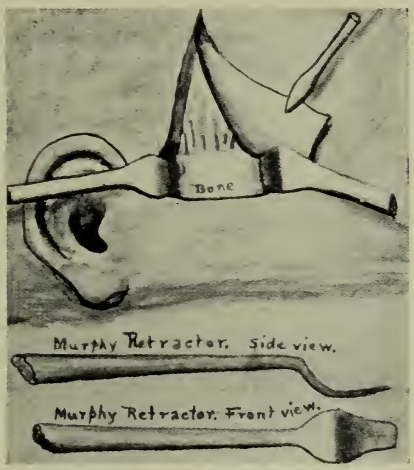


Fig. 2—Shows the bone exposed and isolated by the retractors.

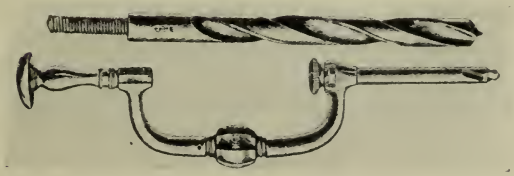


Fig. 3.—Cranial drill.

Case I.—I. E., male, Italian, aged thirty-seven years. Admitted to the Emergency Hospital July 26, 1915.

Previous History. When about twelve years old the patient had a fall, striking his chin and injuring his jaw. Since that time he has been unable to open his mouth or chew solid food. Until five years ago there has been very slight movement in the joint, but he was able to eat only by putting food in through a gap where two incisor teeth had been removed and mashing it with his tongue against the roof of his mouth. But for the last five years there has been no motion at all of the jaw.

Present Condition. Rather small man, fairly well nourished and normal in all respects except the absolute rigidity of the jaw and the retracted chin, which always follows injury to the neck and head of the mandible. He is extremely anxious to have an operation done for his relief, and says he would rather be killed than live in his present condition. Roentgenograms showed a massive bony ankylosis of both sides.

Operation, July 28, 1915: A vertical incision was made a half-inch in front of the auditory meatus, extending from the upper border of the zygoma downward about an inch and a half. From the upper angle the incision was carried transversely across the cheek for an inch and a quarter. The bone was exposed, care being taken to avoid the parotid gland and Stenson's duct. It was impossible to find any line of demarcation between the ramus and the zygoma or base of the skull. The ramus was an inch and a half wide and was finally exposed low enough down to find a free edge anteriorly and posteriorly. A flexible retractor was then inserted under the ramus and it was cut away with gouge chisels without hammering and pointed at the articular side somewhat like the normal head and neck. A flap of periosteum was turned down from the zygoma and inserted between the cut bone surfaces. The same operation was then done on the other side, but a piece of the parotid gland

was cut off and the internal maxillary artery wounded by a slight slip of the chisel. Bleeding was controlled temporarily by gauze packing, and after the bone had been cut away the artery was tied by passing catgut in a small curved needle under it. The periosteum was so thin over the zygoma that no satisfactory flap could be obtained. The wounds were closed and the jaw found slightly movable but still quite rigid on account of muscular contraction. Attempting to pry open the teeth resulted in knocking out three or four before it was found that they were extremely loose from disuse and shelled off as easily as grains of corn from a cob. Finally a mouth gag was placed in between two moderately firm molars and an inch cork put in between the jaws in front.

The next day this cork was removed and it was found that the patient could open and close his jaw to the extent of about half an inch. Later by the use of gradual dilatations with ordinary lead expansion screws, such as are used by carpenters, the range of motion was increased to one inch, and when last seen, sixteen months after the operation, the range was one and one-quarter inches. Cutting the parotid gland caused a salivary fistula on one side which did not completely heal for seven weeks, otherwise convalescence was normal, and the scars, when last seen, were hardly noticeable.

Case II.—D. D., white male, single, aged thirty-two years. Admitted to the Emergency Hospital February 12, 1916.

Previous History. When about ten years old the patient fell from a cherry tree, striking on his chin. After recovery from the acute injury the jaw was very stiff and sore, and this rigidity increased until he was unable to eat solid food. A year or so later he was taken to a hospital where the jaw was opened forcibly under an anesthetic. This gave temporary relief, but in a few months the condition was worse

than before. Several years later he was again taken to the same hospital and another attempt was made to break up the ankylosis by forcible dilatation under ether. This time the attempt was not successful and several teeth were knocked out in the attempt to pry open the jaw. After that there was complete immobility. As in the previous case, food was introduced through a space left by the loss of an incisor tooth and masticated with the tongue.

Condition on Admission. Tall, slender, very intelligent young man, with the usual receding chin and complete immobility of the jaw. He was pale, not very well nourished and very sensitive about his condition. An excellent series of roentgenograms was made by Dr. Thomas A. Groover showing the usual bony mass about the mandibular articulation on the right side; but the left articulation seemed nearly normal. The chin was drawn slightly toward the affected side and the cheek on that side was fuller and more rounded. This corresponds to Dr. Murphy's observation that the best looking side is the affected one in unilateral cases. This is due to the shortening of the ramus at the point of fracture or disease. The patient had several badly decayed teeth, but had never had toothache.

Operation an hour after admission, February 12, was similar in all respects to that described in Case I, except that it was done on the right side only and without accident of any kind except cutting off a small piece of the parotid. The operation was much facilitated by passing the curved handle of a bone forceps behind the ramus, first on one side and then on the other, and boring out the bone with my cranial drill. No flap was interposed, but the articulating end of the ramus was cut to a rounding point. After section of the right side the jaw was found movable and pried open about an inch, very carefully with a pair of Goodell uterine dilators, one on either side between the molar teeth. This was done to stretch the muscles, which were much contracted.

After-treatment. There was no special after-treatment for a week. Then I turned the patient over to my dentist, Dr. A. B. Cooper, who gave him the expansion screws and later small dental jack-screws and taught him how to use them himself and how to tighten them up a little more each day as the muscles relaxed. He wore them mainly at night, with a silk thread attached to prevent swallowing them during sleep. At the end of three weeks he could open and close his mouth without discomfort, almost to a normal degree. The range of motion is now an inch and a quarter and the patient has a new set of teeth. The wound healed readily except for a small salivary fistula, which persisted for six weeks but did not necessitate confinement. The patient sat up on the third day and was comfortable and was discharged from the hospital on the tenth day after operation. He is now well, eating without difficulty and about the most pleased patient I have ever had.

Case III.—Miss D. J., female, white, aged twenty-two years, single. Patient of Dr. A. R. Shands. Admitted to the Emergency Hospital September 14, 1916.

Previous History. The patient had had an acute suppuration of middle ear following measles when four years old. The ear-drum burst and drained for some weeks and was followed by soreness and stiffness of the jaw, which finally became fixed and has remained so for eighteen years.

Condition on Admission. A very intelligent young lady, of medium size, well nourished, but with soft muscles. No teeth had been lost but the lower jaw was so much retracted that the lower incisors were half an inch back of the upper incisors, leaving a gap through which food was introduced. Jaw absolutely rigid. Chin drawn slightly to right side and right cheek fuller than left. Roentgenograms made by Dr. Groover showed a heavy mass of bone about the right mandibular articulation and the left joint apparently normal.

Operation September 15, by Dr. Shands, with my assistance. Dr. Shands attempted to operate through a straight transverse incision over the zygoma, but was obliged to make an L running down a half-inch in front of the ear in order to get sufficient room. The bone was cut as in the previous cases, with cranial drill and gouge chisel, without hammering and trimmed with bone forceps. Immediately on section of the bone there was a wide separation and the mouth opened easily an inch and a half. A small piece of parotid gland was cut off in spite of our care to avoid it. No flap was used between the cut bone surfaces.

After-treatment. No special after-treatment was used. The muscles were not contracted as in the previous cases and the patient was able to eat in a few days without discomfort. The wound healed readily except for a small salivary fistula which had almost entirely healed when she returned to her home in North Carolina in November, 1916. I advised Dr. Shands to teach her to use the expansion screws and have her use them on the slightest sign of recurrence, but so far it has not been considered necessary.

Case IV.—L. C., male, white, aged twenty-seven years, single. Referred by Dr. Thomas Grasty, September 19, 1917.

Previous History. A fall on the chin when five years old. Jaw has been rigid ever since he can remember. Usual deformity.

Condition on Admission. Complete fixation of the jaw with the usual deformity seen in one-sided cases. Murphy operation at the Emergency Hospital September 22, 1917. Flap of temporal fascia stitched between the severed bones. Rigid muscles stretched with mouth gag between molar teeth. Primary union. Patient reported September 30, 1920, three years after operation. Result excellent. Opening one and one-quarter inches.

Case V. Female, colored, aged eighteen years. Referred by Dr. Bailey.

Previous History. Fall on chin when fourteen years old. This was followed by severe pain, soreness and swelling of jaw on the left side.

Condition on Admission. Stiffness increased gradually to complete rigidity in about a year. Usual deformity. Murphy operation at the Emergency Hospital April 12, 1918. No accident or complications. Mouth opened easily. Result excellent after two and one-half years.

Case VI.—Miss A. J. N., white, single, aged thirty-seven years.

Previous History. Abscess near the maxillary articulation following diphtheria when a small child.

Condition on Admission. Seen first in September, 1920; had the usual rigidity and deformity; jaw rigid ever since she could remember. Has very bad teeth, with abscess at the roots of several, and x-rays show two impacted molars on the affected side. Upon consultation with her dentist, Dr. A. B. Cooper, it was decided to remove all her teeth at the time of operation.

Operation at the Emergency Hospital, October 18, 1920. Murphy operation. Extraction of teeth by Dr. Cooper. No accident or complication except that the teeth were very difficult to extract. Several broke off and the roots were dug out with an elevator. She complained greatly of pain where the teeth were extracted for some time and of great soreness of the gums. Also complained of a discharge from the ear, which Dr. Piggott (her ear specialist) said was due to an old middle-ear disease with perforation of the drum. She had no pain in the operative wound, which healed *per primam.* She was much pleased with the result of operation, and when last seen, a month later, had quite free movement.

DISCUSSION

Dr. William S. Baer, Baltimore, Maryland.—I was interested in that part of the paper which is a continuation of his paper of 1916; at the same time I had the opportunity to present a small paper on the same subject. I hardly think the downward incision is necessary.

The incision goes down straight on the face, and in case one makes two incisions there is an angle, and I think the first part of the angle is not necessary. There we may get into some trouble with the parotid gland. The operation mechanically is very simple. If one makes a simple incision parallel to and below the zygoma and not above it, as Dr. Murphy did, just through the skin and subcutaneous tissue, and then separates the muscle from the front of the ramus, it looks like pulling it apart. One can cut down on the ramus of the jaw. One can cut through the periosteum of the ramus and do subperiosteal resection of the condyle of the jaw together with the coronoid process. I do that with mallet and chisel, and yet it seems so easy that one can entirely disarticulate the jaw. One must remember that the temporal muscle is attached to the posterior side of the ramus itself and the periosteum below is left. That has part of the action of pulling up the jaw and shutting the mouth tight. So one is doing a subperiosteal operation.

Recently I had the pleasure of reporting at the Southern Medical Association 22 cases, done in the past ten years. We are having patients some of whom have had ankylosis of the jaw for forty years and cannot get their teeth fixed because they cannot open the mouth. Of the twenty-two cases I reported one had synostosis of the bone, so that there was no differentiation between the upper and lower jaw as far down as the molar teeth. We succeeded in getting one jaw open, but we failed in the other. Other cases have been successful.

In regard to the flap I do not know, but possibly Dr. Carr is right in saying we do not need any intervening flap or intervening membrane. Personally, I have used pig's bladder and have substituted it between the jaw itself. In the earlier cases I simply resected, but did not succeed, as Dr. Carr's first case did, with pure resection without any interposition.

Dr. V. P. Blair, St. Louis, Missouri.—There is one point I would like to bring out in connection with operating for bony

ankylosis of the jaw, and that is we should cut off a piece of the coronoid process obliquely so as not to leave bone sticking up. It interferes with movement. A great many of these cases occur very early and we operate on quite a number of children.

Slide. Here is a child that had gonorrheal ophthalmia at birth, with ankylosis of the jaw, resulting in disability when two years of age. If one looks at this slide he will see there is ankylosis of the side, giving that length (indicating) almost, while the ramus is that length. I think we can carry the jaw forward by some appliance and make a fairly symmetrical mouth. In cases of double ankylosis, which are not uncommon, especially with considerable scarring, we have a harder problem to deal with.

Slide. Here is a child, three years of age, whose jaw has probably not grown in two years, and with it we have double ankylosis. Both epiphyses are destroyed and there are not enough teeth to put on any appliance which will hold the jaw forward when the child is six years of age. Here the deformity is just as much increased, and it is not known what we can do with this case.

Slide. Here is the status of a child that is twelve years of age, with double bony ankylosis. A double operation was done and at the same time the body of the jaw dragged forward until the incisor teeth were more than one-eighth of an inch in front of the uppers, held there for several weeks, the jaw remaining in that position and the teeth bent back by an orthodontist. The jaw was not growing in length, and after sixteen years of age one can see the jaw is again receding. The receded jaw can be corrected considerably by implanting cartilage and the skin together, drawing the jaw forward, and the cartilage transplant will help to relieve it in that case.

Dr. Carr (closing the discussion).—The condition Dr. Baer found must have been different in some respects from that which I encountered. Here is the zygoma (indicating on blackboard) which in my cases was solidly ankylosed to the ramus of the jaw, and we could not find any line of demarcation or sign of a joint. There was no appearance of a notch or coronoid process.

ACUTE INTESTINAL OBSTRUCTION, DUE TO STRANGULATION OF A LOOP OF SMALL INTESTINE BY MECKEL'S DIVERTICULUM; OPERATION WITHIN TWELVE HOURS; RECOVERY

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New York

and

Stanley T. Fortuine, M.D.
Cambridge, N. Y.

Meckel's diverticulum is a congenital anomaly caused by a persistence of the protruded portion of the small gut, which is known as the intra-abdominal portion of the vitelline duct, and which is normally obliterated during the seventh week of fetal life. The vitelline duct connects the gut with the yolk sac at an early period of embryological development. It assumes most commonly the form of a finger-like protrusion ending, as a rule, blindly from the terminal ileum, usually about one meter from the ileocecal junction. It most often springs from a point opposite the mesenteric border and generally has a smaller lumen than the adjacent coils of the ileum. It is of fairly common occurrence, being found in about 1 per cent. of all subjects. Since the process of obliteration may be arrested at any stage it naturally follows that there may be all degrees, from the most frequently observed shallow pouch of 1 or 2 cm. in depth to the patent diverticulum which preserves its connection with the umbilicus and from which a small amount of mucus exudes, mixed at times

with watery fecal material and constituting a persistent umbilical fistula. A common variety is seen as a protrusion about the size and shape of a glove finger and possessing a rudimentary mesentery. Sometimes its distal portion is dilated so that it assumes a bulbous appearance. There is usually a persistence of all the coats normally found in the small intestine, and histologically the mucosa resembles that of the ileum.

There are a number of pathological conditions in which the diverticulum of Meckel becomes involved, although, considering its incidence in 1 per cent. of all subjects, it is not commonly the seat of trouble. Perhaps inflammatory processes are among the most frequent, and diverticulitis is attended by a symptomatology that renders its differentiation from appendicitis extremely difficult.

Intestinal obstruction due to Meckel's diverticulum may be produced in several different ways:

1. Volvulus may take place by rotation of the ileum about its mesenteric border, caused by the lever action of the distended diverticulum.

2. Intussusception has occurred due to the invagination of an inverted diverticulum into the ileum forming the starting-point for a progressing intussusception.

3. The commonest form of obstruction is caused by the diverticulum assuming the role of a band and causing strangulation of bowel loops caught between it and its attachment to the intestine and to the abdominal wall, generally at or near the umbilicus, or more rarely to the posterior parietal peritoneum near the root of the mesentery. As the obstruction grows more acute the diverticulum, as well as the obstructed coils of gut, becomes gangrenous and perforation may occur.

Report of a Personal Case. E. P., male, aged twenty-six years, admitted to the Mary McClellan Hospital, of Cambridge, New York, on June 6, 1920. He was brought to the hospital by Dr. Charles H. Holmes of Buskirk, at 7 P.M.,

with the following history. The patient was a farmer and had always enjoyed excellent health; no previous abdominal symptoms. On Sunday, the day of admission, he had a good breakfast; shortly afterward he began to feel slight nausea and discomfort in the epigastrium. He stated he felt as if his abdomen had been struck. He went about doing his ordinary work after breakfast. One hour later he began to have severe paroxysmal pains low down in the abdomen, which he characterized as "doubling-up" pains. These pains recurred at intervals of a few minutes. The paroxysms continued to grow worse. He vomited for the first time one and a half hours after his breakfast, and twice in addition before operation. The bowels had not moved in the morning of the onset and he had been somewhat constipated the night before. He stated that he had climbed inside of a chimney the day before; he had no fall and made no misstep, but was very much exhausted by the effort.

Previous History. No similar previous attacks. Had had occasional vomiting attacks, with pain, after riding over rough roads. No history of indigestion. He does not remember any previous illness.

Physical Examination on Admission to the Hospital. Well-built young adult, apparently about twenty-five years of age; suffering from frequent attacks of paroxysmal abdominal pains, localized in no particular spot, centering, roughly speaking, about the umbilicus; slight tenderness in the right iliac fossa and region of McBurney's point, but no rigidity of the rectus muscle. Rectal examination negative; no mass palpable in any portion of the abdomen; no localized distention of coils of intestine in any portion of the abdomen. Heart and lungs negative. A provisional diagnosis of acute appendicitis had been made before he entered the hospital.

I first saw him at 8 P.M. Sunday evening, eleven hours after the onset of his symptoms. Physical examination showed the conditions just described: Temperature, 98.6°; pulse, 72. (Rectal temperature taken showed 99.2°.) Blood examina-

tion: Whites, 12,400; polynuclears, 90 per cent.; large lymphocytes, 2.5 per cent.; small lymphocytes, 7.5 per cent. I was unwilling to make a diagnosis of acute appendicitis, chiefly on the ground that the severe abdominal symptoms could scarcely be present without perforation of a gangrenous appendix, and if this were the case there would have been some evidence in the way of localized tenderness and rigidity. In addition one would not expect to have found normal pulse and temperature.

While we were unable to make a definite diagnosis of the condition we felt certain that the very severe, steadily increasing paroxysmal pains, and particularly the general appearance of the patient—which was that of a person suffering from severe shock—made immediate exploration not only desirable but imperative. The patient was accordingly taken to the operating room and operated upon as soon as possible, with the assistance of Stanley T. Fortuine, the Resident Surgeon. A vertical incision of the right rectus was made under ether anesthesia. There was a large amount of clear fluid in the peritoneal cavity. At first nothing but deeply congested, distended coils of small intestine could be found. The appendix was normal. After careful search a loop of small intestine, about 1½ to 2 feet in length, was found, greatly distended and dark in color, but not gangrenous, located in the bottom of the abdomen, somewhat more to the right side than to the left, a little above the pelvis. This loop of bowel was found to be strangulated by what seemed to be another loop of intestine, firmly attached below and connected with a loop of small intestine above. The constriction was so tight that it was absolutely impossible to withdraw or free the strangulated loop. It took some time to recognize the exact anatomical condition, but it soon became apparent that we were dealing with a Meckel diverticulum, nearly of the same caliber as the normal small intestine, coming off at right angle from the lower portion of

the ileum, about 2 feet from the ileocecal valve and extending downward to the root of the mesentery, and attached so firmly that it required a great deal of manipulation to dissect it off without tearing it. When the distal end was finally freed, the strangulated loop slowly regained its color and, under hot towels, became apparently viable. The diverticulum was about 5 inches in length, had a rudimentary mesentery and tapered slightly in its distal end. It was of a deep, dark red color, almost gangrenous in appearance, due to the great pressure of the distended coil beneath it, which was less dark than the diverticulum itself. The diverticulum was clamped off close to the wall of the intestine from which it had sprung, and the opening into the intestine, which was about 1½ inches in diameter, was closed with two rows of fine chromic-gut suture; the abdominal wound was closed without drainage. A cigarette drain was placed at the site of the stump. The patient made an uninterrupted recovery and has been in good health up to the present time.

Reginald Fitz's classical paper on "Acute Intestinal Obstruction," read before the Congress of American Physicians and Surgeons, in Washington, September, 1888, represents the most complete discussion of the subject that had thus far appeared. It contains a critical analysis of 295 cases collected from the surgical literature, with careful elimination of all cases in which full data were lacking. These 295 cases are classified as follows:

Strangulation	101 cases
Intussusception	93 "
Abnormal contents	44 "
Twists and knots	42 "
Strictures and tumors	15 "

Of the 101 cases of strangulation, 63 were due to adhesions, 21 to vitelline remains, 6 to adherent appendix, 6 to mesen-

teric and omental slits and 3 to peritoneal pouches and openings, 1 to adherent tube and 1 to pedunculated tumor.

Seventy per cent. of the obstruction from strangulation occurred in males. In 82 per cent. of all the cases of strangulation, pain was the first and most important symptom, usually sudden, severe and colicky, and most frequently starting in the region of the umbilicus. In 69 per cent. of the cases nausea or vomiting was associated with the pain.

Tympanitic distention of the abdomen occurred in slightly over half of the cases, most often after the first to the sixth day. Slight rise of temperature, usually below 100° F., was noted in about one-half of the cases. The position of the strangulating object was found in the right iliac fossa in 67 per cent. of the cases and in the lower abdomen in 83 per cent. In the cases treated medically, death occurred in half of the cases from the second to the fourth days.

Fitz's paper brings out in a striking manner the great difference between the methods of treatment of intestinal obstruction in 1888 and the present time. Operation was performed in 67 per cent. of the cases of strangulation with 41 deaths, or a mortality of 61 per cent. Of the 67 cases operated upon with 41 deaths it is interesting to note that operation was performed on or after the third day in 39 of the cases and in 32 on or after the fifth day. In other words, in 1888 early treatment of acute intestinal obstruction was practically always medical. In fact, Fitz himself states: "In the light of the published experience of the past eight years the medical treatment of acute obstruction is limited to the use of injections during the first three days, under sufficient degrees of pressure, within fixed limits, to determine the patency of the large intestine. If it proves impassable the case is no longer medical but surgical." In conclusion, Fitz says: "Acute intestinal obstruction is diagnosticated by exclusion and the seat is fixed by injection. Its variety is determined by its seat, the age, antecedents and symptoms of the patient. Its treatment is surgical on or after the third

day if the symptoms are urgent and forced injections fail to relieve."

In strangulation by Meckel's diverticulum I believe the most important diagnostic symptom is severe, colicky pain with frequently recurring paroxysms, non-localized, nausea and vomiting, complete absence of stools and absence of tenderness and rigidity. Next in importance to the pain is the general appearance of the patient which is more or less that of a person suffering from shock.

CASES OF STRANGULATION FROM MECKEL'S DIVERTICULUM REPORTED IN RECENT LITERATURE

CASES I AND II.—Jas. E. Thompson reported 2 cases of intestinal obstruction, due to Meckel's diverticulum, before the meeting of the Southern Surgical Association in St. Louis in 1897. Case I was an acute strangulation of the ileum under a bridge formed by Meckel's diverticulum, the symptoms lasting five days; operation; death. The patient was a young man, aged twenty-nine years, who when first seen by Dr. Thompson had been suffering from severe symptoms of intestinal obstruction for five days. The attack began with very severe abdominal pain. He had been treated by repeated doses of strong purgatives and enematas without success. Temperature, 99°; pulse, 72; moderate distention. Immediate operation was advised, but refused until the following day. A loop of small intestine was found strangulated by a band in the right iliac fossa; this band proved to be a short, stumpy Meckel's diverticulum, 1½ inches long. The distention was so great that some of the coils had to be emptied of gas before the intestine could be replaced. The patient died of shock a few hours later. The second case, while classed by Dr. Thompson as a case of intestinal obstruction due to Meckel's diverticulum, is really a case of strangulated inguinal hernia, which had been reduced by prolonged taxis on the part of the patient himself. The taxis caused a

rupture at the root of Meckel's diverticulum, resulting in peritonitis, for which the operation was done at a late stage without avail. Hence, this case can hardly be classed as an obstruction due to strangulation by a Meckel's diverticulum.

Case III.—Another case of intestinal obstruction due to Meckel's diverticulum is that reported by E. W. Sympson.[1]

The patient, a youth, aged twenty-one years, was admitted to the Lincoln County Hospital on May 1, 1917, suffering from acute intestinal obstruction. Acute peritonitis two years previously. Two days before admission to the hospital he had an attack of sudden, acute pain over the whole abdomen, spasmodic in type and followed by persistent vomiting, which, within twelve hours, became definitely stercoraceous; there had been absolute constipation from the start. Temperature, 97°; pulse, 130, feeble. Provisional diagnosis of "strangulation by bands" was made. On operation a Meckel's diverticulum was found about 2 feet above the ileocecal valve; it was about 4 inches long, adherent at its tip to the posterior abdominal wall and to the root of the mesentery opposite the second lumbar vertebra, and forming an aperture through which about 2 feet of ileum had become prolapsed and strangulated. The patient made an uninterrupted recovery and was discharged four weeks after operation.

Cases IV, V, VI and VII.—Roscoe Graham,[2] reports 4 cases of intestinal obstruction due to Meckel's diverticulum, three of which were operated upon by Dr. F. N. G. Starr.

(*a*) The first patient, a woman, married, aged forty-five years, was admitted to the Toronto General Hospital, complaining of severe pain in the right iliac region, which had

[1] Lancet, June 30, 1917, p. 998.

[2] In the Journal of the Canadian Medical Association, November, 1918, viii, 966.

Loop of small intestine strangulated beneath a Meckel's diverticulum.

come on suddenly eight days before and lasted for three days, accompanied by considerable vomiting. She had had more or less discomfort in this region ever since her first child was born, sixteen years ago. After the third day the pains became less severe, but left a dull soreness. Examination showed a temperature of 102°; pulse, 100; slight muscular rigidity on the right side and tenderness on palpation. Operation: Evacuation of appendicular abscess and removal of organ. After doing well for three days the patient became steadily worse and the probable diagnosis of paralytic ileus was made; further operating was considered inadvisable. The patient died a week after operation. Postmortem examination showed, 18 inches from the ileocecal valve, a volvulus of the ileum produced by Meckel's diverticulum which had caused almost complete obstruction.

(*b*) The second patient, a female, was admitted to the Toronto General Hospital on October 9, 1916 (Dr. F. N. G. Starr). She complained of pelvic pains which had existed for the past two years. Abdominal examination showed nothing abnormal. Vaginal examination revealed a cervical polyp and marked retroversion. Operation, October 10. Removal of polyp and appendix; correction of retroversion. Uneventful progress for first ten days; then the pulse became more rapid and nausea set in. There was great distention. The pulse-rate reached 120. After further examination a tentative diagnosis of obstruction of small intestine was made. On operation coils of the small intestine were found collapsed and on following them up it was seen that they herniated under a Meckel diverticulum, which was attached to the convex border of the ileum and to the superior aspect of its mesentery. The obstruction was relieved and the diverticulum amputated. The patient died twenty-four hours after operation.

(*c*) The third patient, a woman, was admitted to the Toronto General Hospital on November 31, 1916, to the service of Dr. Starr. She complained of abdominal swelling,

which she had noticed for the past few months and which was accompanied by vomiting and obstinate constipation. The appendix had been removed two years previously, and she had a ventral hernia. After examination the diagnosis of ovarian cyst was made and operation advised. It was found that the cyst arose from between the layers of the left broad ligament. On separating the adhesions a mass of adherent intestine was found, from which ran a diverticulum which was attached to the cyst wall. It was deemed best to resect the bowel and an end-to-end anastomosis was made. Uninterrupted recovery.

(*d*) The fourth patient, a boy, aged fourteen years, was admitted to the Toronto General Hospital (Dr. Starr) on December 3, 1915, complaining of abdominal pains. He had had two previous attacks, but the symptoms always disappeared after a few hours. This time they persisted. After careful examination the tentative diagnosis of internal hernia was suggested, possibly caused by Meckel's diverticulum, despite the fact that the case clinically simulated appendicitis. On operation a hernia was found under a Meckel diverticulum, very much the same as in the preceding case, except that a small loop of bowel was herniated, the rest having reduced itself spontaneously.

Case VIII.—Habhegger[1] publishes a case of intestinal obstruction due to a Meckel diverticulum in a girl, aged eight years. She was taken sick on November 26, 1917, with severe abdominal pains which recurred intermittently and were followed by vomiting, first, of mucous bile, later dark, brownish material; no bowel movements; no flatus. Examination ten hours after the onset of the attack showed the patient to be evidently desperately ill. Temperature, normal; pulse, soft and irregular; blood-pressure, 40. Facial expression natural. Abdomen uniformly distended; diffuse tenderness

[1] Interstate Medical Journal, September, 1916.

over the entire lower part of the abdomen; tympany everywhere; no muscular rigidity. The diagnosis of intestinal obstruction and paralytic ileus considered, but the clinical picture of collapse, apathy and stupor did not fit either condition. Operation was, of course, indicated, but not feasible for obvious reasons. The child grew progressively worse and all attempts to relieve the bowel were futile. She died twenty-three hours after the onset of the attack with all symptoms of collapse due to intense intoxication. Autopsy revealed a large mass of reddish, bluish-black small intestine, greatly distended and filling the whole abdominal cavity; large intestine normal. No fluid in peritoneal cavity. Further examination of the small intestine showed it strangulated by a round band which encircled the base of the mass of discolored bowel. The intestine involved was the jejunum at its junction of the duodenum and ileum within a few feet of the cecum. The band was 4 inches in length and attached to the ileum, about 2 feet above the ileocecal valve and on its other extremity to the root of the mesentery of the jejunum near the spine. Through this opening, about 4 inches in diameter, about 12 feet of small intestine had prolapsed. Practically the entire small intestine was involved.

Case IX.—R. A. Bennett[1] publishes a case of intestinal obstruction due to a Meckel diverticulum, in a girl, aged thirteen years. She was admitted to the Torbay Hospital, Torquay, on November 21, 1918 (Dr. A. Spong), with a history of sudden abdominal pain, setting in four days previously after a hearty meal. The pain was not intense nor localized. Vomiting soon followed and the patient has been more or less sick ever since. No bowel movement since the onset of the attack; no flatus. Temperature, 98.6° F.; pulse, 128; respirations, 24. The whole abdomen was rigid and tender, the pain being most pronounced on the left side,

[1] Lancet, June, 1919.

just above the umbilicus. A diagnosis of intestinal obstruction was made and the abdomen was opened at once. Distended, acutely congested small bowel presented, and when pushed aside, revealed collapsed small intestine and colon. After further search, Meckel's diverticulum was found; its proximal portion was a thin and fibrous cord, twisted many times on its axis; the distal part was a dilated pouch, filled with blood clots and adherent to a tag from the great omentum, also inflamed and twisted. The connection had formed an arch under which the lower 4 feet of the ileum had become partially strangulated.

Cases X, XI and XII.—Hohlbeck[1] reports three cases of intestinal occlusion due to a Meckel diverticulum, observed at the City Hospital, with two deaths and one cure. (*a*) A young man, aged eighteen years; July 29, 1894. There was an ileocecal invagination, about ½ foot in length. Drawn into the invagination there was a Meckel diverticulum the size of a walnut which had undergone such changes as to render extirpation necessary. The diverticulum was not inverted *in toto* but only its mucous lining. July 7: No stool; no gases. Patient died in collapse the following day.

(*b*) Boy, aged four and a half years; May 5, 1898. Diverticulum about 6 inches in length, situated 22 cm. above the ileocecal valve and adherent with its blind end to an omental band. Resection of 27 cm. of small intestine together with diverticulum. Murphy's button. The diagnosis of occlusion due to a Meckel diverticulum in this case was made only after examination in narcosis, when a tumor, the size of a small finger, was palpated to the right, below the umbilicus, the torsion of the intestine around its longitudinal axis resulting from the pull of the adherent diverticulum, causing the occlusion.

(*c*) A woman, aged thirty-nine years. October 16, 1899.

[1] Arch. f. Clin. Chir., 1900, Bd. xli, p. 1.

About 40 cm. above the cecum, a loop of ileum is seen to be constricted by a band; farther down this is connected with a diverticulum 23 cm. long, the shape of a cucumber, about 4 cm. at its upper end. The walls of the diverticulum are expanded to the maximum; the serosa is black, also the constricted loop of intestine. Resection of a piece of intestine 80 cm. in length. Murphy's button with Lembert suture on top. Patient discharged, cured, November 10.

Diverticulum incarcerations, according to Leichtenstern, are much more frequent in men than in women, his statistics, comprising 66 cases, showing 52 males and 14 females. The prognosis of incarceration due to a Meckel diverticulum is very bad. Boldt collected 55 cases with 15 laparotomies and only 3 cures, a mortality of 80 per cent. Bérard and Delore collected 32 cases of laparotomy for occlusion due to a Meckel diverticulum, with 9 cures and 23 deaths, a mortality of 72 per cent. Hohlbeck states that Kelynack's opinion, holding Meckel's diverticulum to be harmless formation, certainly seems remarkable. He found a Meckel diverticulum 18 times in 1446 cadavers, and in none of these was the cause of death in any way related to the diverticulum I believe that the mortality of acute intestinal obstruction from a Meckel diverticulum should be greatly reduced if operation is done early—say, within the first twelve hours, instead of after two or three days, as has been the case in most of the cases operated upon.

Case XIII.—Fergus, Intestinal Obstruction Caused by a Meckel Diverticulum.[1] The patient, a young woman, aged nineteen years, was evidently acutely ill; temperature up; pulse rapid; obstinate constipation; pain and tenderness, all over the abdomen, spasmodic in character; rigidity of muscles; vomiting; considerable distention. Diagnosis of intestinal obstruction made; operation advised; removed by

[1] Glasgow Medical Journal, 1915, lxxxiv, p. 12.

ambulance to one of the nurses' homes, where she was operated upon by Dr. Dalziel. The small intestine was found intensely congested, of a dull, reddish-purple color and greatly distended. The obstruction was found to be due to a Meckel diverticulum, about 8 inches in length and of a caliber nearly equal to that of the small intestine; it had firmly strangled the small intestine, the distal end of the diverticulum being bound down by fresh adhesions. The diverticulum was freed, but in view of the congested condition of the small intestine above the obstruction it was not considered advisable to do more than relieve the obstruction and free the diverticulum, which was returned into the abdomen and the wound closed. The patient made a good recovery. The diverticulum was removed in a second operation a few months later. She has been in good health since.

Case XIV. Drybrough-Smith, Acute Intestinal Obstruction by a Meckel diverticulum.[1] Operation, June 30, 1917, done on an infant, seven days old. The child had a patent Meckel diverticulum at birth, protruding from the umbilical cord just beyond its attachment to the skin. The bowel acted through this opening as well as by the natural passage. On the fifth day after birth the child began to vomit and gradually intestinal obstruction became complete. On opening the abdomen it was seen that the ileum had invaginated itself into Meckel's diverticulum, dragging with it the mesentery.

Case XV.—W. F. Pearce, Perforation of a Meckel Diverticulum and Accompanying Appendicitis.[2] Patient, male, U. S. Naval Reserve Corps, was brought to the hospital on December 25, 1918. For the last two or three days slight discomfort in the abdomen. On the morning of the twenty-fifth severe pain in the region of the umbilicus, later shifting

[1] Lancet, London, 1917, ii, p. 24.

[2] U. S. Naval Medical Bulletin, Washington, 1919, xiii, p. 346.

to a Meckel diverticulum; vomited several times. Temperature, 98.6° F.; pulse, 120; pinched expression of face; abdomen very sensitive, particularly over McBurney's point; marked muscular rigidity. Immediate operation. A large amount of greenish-gray fluid was encountered. Appendix inflamed; sharply kinked in beginning gangrene, but not perforated; removed. Further careful search discloses a Meckel diverticulum, definitely inflamed and with a perforation about midway between the tip and the base; removed; stump inverted; two drains placed and incision closed in layers. Eight days after operation the temperature was normal and drainage ceased on tenth day. The patient was up and about and the wound closed at the time of the report. The diverticulum in this case was 4 cm. in length; 2.5 cm. at top and 3 cm. at base.

Case XVI.—E. A. Wilkins, A Case of Adherent Meckel Diverticulum Causing Fatal Strangulation.[1] Case, male, aged twenty-two years; farmer; sudden onset of severe, colicky pains in umbilical region; moderate vomiting; slight abdominal tenderness; no rigidity nor distention. Pulse full and strong; temperature normal; face of good color. Intestinal obstruction considered but thought unlikely; turpentine enemas gave relief. Not called to see patient again until the next day, 11 A.M. Then pains were very severe; abdomen full; rigidity; great tenderness. Temperature, 101°; pulse slightly above normal but strong. No vomiting since. Immediate removal to hospital; operation done two hours later by H. T. Dawson. A large tumor became evident under anesthesia in midabdomen. On incision black blood ran out and two large coils of black small intestine presented; a constricting band was felt across the root of the coils, which gave way under the finger and was not seen. No normal viscera seen; everything black; very little

[1] Med. Press, London, 1919, xvii, p. 10.

distention; wound closed. Severe pain, tenderness and rigidity continued for four days, requiring morphin; enemas failed to give relief; no vomiting. Pulse continued good and but little above normal until a day before death. Post mortem showed a perforation in the strangulated bowel, which had not recovered. A Meckel diverticulum, 4 inches long, $\frac{3}{4}$ inch wide at base and tapering to a point, was found, the end of which was rough and evidently had been adherent. Fully 4 feet of bowel had been strangulated. Wilkins states that this case shows that severe strangulation can occur without distressing vomiting and with a good pulse.

Hertzler and Gibson, of Kansas City, Mo.,[1] in addition to reporting a personal case of invagination of a Meckel diverticulum, associated with intussusception, have made a careful study of the recorded cases and append brief histories of 41 cases of invagination of a Meckel diverticulum, associated with intussusception, in which sufficient data were obtainable to permit a judgment of the anatomical character of the lesion. All other incompletely reported cases are omitted.

In this series the age of the patients varies from seven months to thirty-nine years, the average being thirteen years; 20, or 49 per cent., of the cases were under ten years of age, 10 between ten and twenty years. The sex is given in 38 cases, 31 being males, 7 females. In 17 of the 41 cases a history of previous attacks is definitely given. In 3 a single attack is mentioned; in 9 repeated attacks. Vomiting was recorded present in 24 cases and its character was usually dark-green or yellowish. The authors state that vomiting, compared to many types of intestinal obstruction, is characterized by its moderate intensity. Of the cases in which resection was done, insofar as definite information is available, 13 died and 9 recovered. Five of these cases came to operation from the sixth to the eight day after the onset of the symptoms, indicating a subacute process. Of those in which

[1] Am. Jour. Med. Sc., 1913, cxlvi, p. 364.

reduction was feasible, requiring the removal of the diverticulum only, 9 recovered and 4 died.

Case XVII.—Their personal case was a youth, aged nineteen years. Two years before he had an attack of abdominal pains, which he ascribed to eating raisins. The attending physician found a tumor immediately below the umbilicus, which he supposed to be a mass of raisins. He manipulated it with his fingers in order to break up the lump. The symptoms subsided and the patient had no trouble until December 18, 1912, when he became chilly and nauseated; better after two days; then after a hearty breakfast had severe pain, followed by vomiting. The pains increased and morphin was administered; enemas were also given but the symptoms continued. A tumor was palpated to the right of the median line. At last the patient was brought to the Halsted Hospital with the diagnosis of intestinal obstruction. Examination showed the abdomen but slightly sensitive; no rigidity; moderate distention. Of course, it must be remembered that morphin had been given. Pulse, 144; temperature, 97°; respirations, 24. On opening the abdomen straw-colored fluid escaped; the intestinal coils were injected and greatly distended; no paralysis. The ileocecal portion of the intestine was found lying over the kidney, presenting a tumor, which was seen to be an intussusception through the ileocecal valve, about 12 inches long, with a distinct tumor at its upper extremity. This was found to be an inverted Meckel diverticulum, with a thickened apex about 2½ inches long. The diverticulum was replaced; the mass in its apex was about the size of a walnut. The diverticulum was clamped just above the solid mass and mattress sutures passed on the ileal side of the clamp; the latter were removed and the gut severed. Inversion of the end into the lumen of the gut; the cecum was replaced and a loop of ileum containing a stump of diverticulum was pulled over above and distal to the cecum. During the first days there was profuse

drainage which gradually became reduced and drains were removed.

As regards the frequency of a Meckel diverticulum, statistics vary greatly. Its frequency, based upon autopsy reports is given, as 1 to 2 per cent. In 18,000 autopsy examinations of subjects who died of other trouble 15 cases of a Meckel diverticulum were found, making it less than 1 per cent.

The interval of time elapsing between the first symptom and the operation varied between two and eight days. In our own case the interval was less than twelve hours, which is the shortest period of time that we have been able to find in any of the recorded cases. As regards the age of the patient in the cases which we have been able to collect the youngest was four and a half years old and the oldest forty-five years; six occurred between the ages of fifteen to twenty-five years.

Balfour in a review of 10,000 successive operations performed at the Mayo Clinic from 1907 to 1910,[1] reports 15 cases of a Meckel diverticulum. Of course, this does not give an accurate idea of the frequency of the anomaly for the reason that in comparatively few cases was there a necessity for a systematic search of the entire intestine. In only 5 of these cases had the diverticulum given rise to symptoms and only one of the five was operated upon for acute intestinal obstruction due to adhesions about an inflamed diverticulum. One was operated upon for a chronic obstruction of the cecum and appendix which had slipped through a loop formed by a long, cord-like Meckel's diverticulum, 9 inches in length. In another case the operation was done for a discharging navel in a child two years of age. It was due to a Meckel diverticulum in connection with the ileum and extended to the umbilicus.

The only case which was operated upon for acute obstruction was a male of five years. In this case there was a large

[1] Collected Papers of St. Mary's Hospital, 1910.

diverticulum extending from the ileum to the umbilicus. It was necessary to do a lateral anastomosis between the loops of the ileum above and below the constricting point. Dr. Finney in his recent exhaustive paper on 300 cases of acute intestinal obstruction, observed at the Johns Hopkins Hospital, over a long period of years, states that there was not a single case of acute obstruction due to Meckel's diverticulum.

DISCUSSION

Dr. Stephen H. Watts, Charlottesville, Virginia.—I have had a rather unusual experience with lesions of Meckel's diverticulum. I have had three cases I can recall offhand of what I have chosen to call Meckel's diverticulitis in which the symptoms were practically the same as those of acute appendicitis and which were treated by amputation of the inflamed diverticulum.

I have had several cases of acute intestinal obstruction due to Meckel's diverticulum, in one of which an intussusception had been produced by inversion of the diverticulum. In a recent case of acute intestinal obstruction due to Meckel's diverticulum, which was adherent beneath the umbilicus, the intestine was greatly distended and the child quite ill. After dividing the diverticulum close to the peritoneum with the actual cautery and relieving the obstruction a tube was inserted into the intestine through the stump of the diverticulum, using it somewhat after the manner of an appendicostomy.

Dr. Alexius McGlannan, Baltimore, Maryland.—In our series of cases of acute intestinal obstruction we have had one case of obstruction around a Meckel's diverticulum which is almost identical with that described by Dr. Coley. This patient was a man, aged fifty years, who fortunately was attended by an extremely capable clinician and sent to the hospital promptly, within twenty-four hours of the onset of the symptoms, with a diagnosis of intestinal obstruction and without any attempt to identify the particular cause of the obstruction. Examination in the hospital gave no indication of Meckel's diverticulum

being the cause of the difficulty. There was no deformity of the umbilicus and no discharge nor tension, but there was a distended abdomen, persistent vomiting, inability to move the bowels with enema, and other general symptoms of intestinal obstruction, including visible peristalsis. The patient was operated on by Dr. George Stewart, resident surgeon, who found an acute intestinal obstruction with gangrene of about fourteen inches of the small intestine, produced by the wrapping of a loop of small intestine around an adherent Meckel's diverticulum. It made a tight knot which completely cut off circulation and caused gangrene. Dr. Stewart resected the gangrenous portions of the bowel, brought the open ends of the small intestine through the abdominal wall and laid them open for the enterostomy. The patient was quite toxic. This case, with suitable illustrations to show the character of the obstruction and position of the various parts, including the diverticulum, will be found in Dr. Cullen's book on *Diseases of the Umbilicus.*

Dr. R. C. Coffey, Portland, Oregon.—During the reading of Dr. Coley's paper I do not know whether he mentioned the question of intussusception in connection with Meckel's diverticulum or not. In 1907 I reported a case in the *Annals of Surgery* in which Meckel's diverticulum became inverted and served to bring about a peristaltic wave, thus producing intussusception in the intestine. An illustration of this case was later reproduced in Binnie's *Operative Surgery.*

Dr. Randolph Winslow, Baltimore, Maryland.—I have always regarded Meckel's diverticulum as an extremely dangerous piece of anatomy. It is an abnormal piece of anatomy, and like abnormal pieces of anatomy it is very dangerous. My impression is that it occurs once in about fifty individuals. At any rate, that is what I have been teaching my students.

I have seen a number of cases of bad effects from Meckel's diverticulum. I have seen personally what Dr. Coffey has just mentioned, intussusception as the result of Meckel's diverticulum. I have also seen Meckel's diverticulum, with the appendix and with the right Fallopian tube mixed up in a mass, so that this firm mass in the right iliac fossa appeared to be, as far as external examination was concerned, an acute appendicitis, but which, when operated on, was seen to be a general conglomeration of Meckel's diverticulum, inflamed tube and an inflamed appendix.

I have known of a number of cases, one of which was a physician in Baltimore, who died as a result of an acute intestinal obstruction, the result of Meckel's diverticulum. I think, therefore, that Meckel's diverticulum is one of the most serious pieces of false anatomy that can befall any of us.

Dr. Henry O. Marcy, Boston, Massachusetts.—In my experience I have had only two cases of intestinal obstruction of this type, both occurring in doctors. I will not go into details. In the first instance the operation was done rather early. Two physicians took care of one of these patients for thirty-six hours in a professional way. One of the patients had taken four ounces of Epsom salts. He was given two ounces of castor oil and eight drops of croton oil. Relief of the obstruction was not particularly serious because it was not of very long duration. But the difficulty was what happened afterward. The patient never vomited. The doctors got busy with him and there were two nurses constantly in attendance in this particular case for twenty-four hours before the intestine was relieved of its contents. The other case was not of such importance and the patient made a good recovery.

I am reminded of the ancedote of the man who had a horse that was sick. He sent his coachman to the drug store for some medicine; at the same time, the owner of the horse was ill and by mistake he took the medicine intended for the horse, and when the druggist asked what was the effect of the medicine, the man replied: "It was fine. It operated twice before the man died and three times after."

Dr. John Wesley Long, Greensboro, North Carolina.—I have had two cases of acute strangulation of the intestine from the intestine being wrapped around a Meckel's diverticulum. Both patients were operated upon and both recovered.

I rise especially to call attention to a case of perforation of Meckel's diverticulum which occurred in the midst of typhoid fever. The patient was a bachelor, living by himself in a cabin a good many miles away from where my office is. A diagnosis of typhoid fever with perforation and extensive peritonitis was made by the attending physician. I opened the patient's abdomen at his home, because he was too ill to be moved. To my astonishment I found what appeared to be a Meckel's diverticulum coming off very near the beginning of the transverse colon. There was a perforation in the bottom of the diverti-

culum. I amputated the diverticulum, and, the neck being small inverted the stump. On examination of the amputated diverticulum it contained a typical typhoid ulcer, through which the perforation had occurred. Many ulcers could be seen and felt in the distal portion of the ileum. The abdomen was drained with tubes and cigarettes. The patient made an uneventful recovery.

Dr. George A. Hendon, Louisville, Kentucky.—My experience in connection with Meckel's diverticulum has led me to look upon this anomaly as carrying potentialities for trouble, among which that of obstruction is merely an incident. The cases I have observed have produced symptoms which very much resemble acute appendicitis, and upon operation proved to be an inflammation or an infection of the diverticulum.

In October, 1910, I prepared a paper for the Kentucky State Medical Association based upon this subject and made a very careful search of the literature. I was able to find about 136 cases reported up to that time in which Meckel's diverticulum produced acute abdominal crises aside from intestinal obstruction. Therefore I have come to regard the production of acute obstruction by Meckel's diverticulum as one probably of the fewest of the dangers to which the abdomen may be subjected by reason of the presence of this anomaly. I have found cases reported in which patients had been operated on for an acute appendicitis and died and at the postmortem an acute diverticulitis proved to be the cause of death.

If anyone is sufficiently interested to search the literature on the subject he will be very much surprised to find numerous abdominal crises brought about by the presence of this anomaly, aside from that of intestinal obstruction.

Dr. W. A. Bryan, Nashville, Tennessee.—I want to report two cases of intestinal obstruction I have seen in connection with Meckel's diverticulum. In one of them, if we had known beforehand what we knew after we opened the abdomen, we would not have operated at all. But the interesting feature in connection with this case was that the diverticulum was pear-shaped, about four and a half inches long and two and a half inches in diameter, filled with fecal matter, the intestine being wound around the proximal end of the diverticulum.

The other case is particularly interesting to those who do

abdominal surgery, for the reason that any of us may go into the abdomen thinking we are going to find an acute appendicitis, and instead find a normal appendix. This case was operated on by a friend of mine who had at that time only a rather limited experience in abdominal surgery. His diagnosis was acute appendicitis. He operated and had great difficulty, I was told by one of his assistants, in removing the appendix. It was said also that the appendix was just about as normal as a man could expect to find it in any individual. He closed up the patient and the symptoms following operation grew worse. He called me in to the case about thirty-six hours after he had operated, and I made a diagnosis of intestinal obstruction. At the operation I found Meckel's diverticulum, the distal end of which was attached at the inner surface of the umbilicus and the intestine wrapped around the diverticulum. When we get a case like that and think we have appendicitis, with all the symptoms that accompany appendicitis, and fail to find a bad appendix or a perforated appendix, with no rigidity, with no vomiting, the leukocyte count normal, subnormal or above normal, I do not think we ought to stop because we have made a mistake; but we ought to investigate and make sure of the condition that really exists. We sometimes profit more by our mistakes than by our successes.

Dr. Thomas S. Cullen, Baltimore, Maryland.—I have listened with much interest to the paper on intestinal obstruction due to Meckel's diverticulum. A patent omphalomesenteric duct, if it be of goodly caliber, may give rise to intestinal obstruction within a few days after the cord comes away. This is caused by the bowel prolapsing through the open umbilicus. Inflammation of Meckel's diverticulum occasionally occurs, and in those cases in which a cord passes from the diverticulum to the umbilicus, loops of small bowel may become twisted around this fixed point causing intestinal obstruction.

Occasionally when the cord comes away a small polyp is found in the umbilical depression. This may be due entirely to granulation tissue. On the other hand it may be a remnant of the outer end of the omphalomesenteric duct. If so its outer surface is covered by intestinal mucosa.

When such an intestinal polyp is found in the umbilical depression one is more likely to find a Meckel's diverticulum attached to the umbilicus. Accordingly in all cases in which

an umbilical polyp has been removed in infancy the parents should be warned to be on the lookout for subsequent intestinal obstruction. If such a condition should develop in after-life a Meckel's diverticulum should at once be considered as the probable causative factor of the obstruction and operation should be promptly undertaken. I have considered these subjects at such length in my book on the umbilicus that further remarks by me would be superfluous.

Dr. Coley (closing the discussion).—In my collection of cases, except recent ones, I have all the varieties mentioned by different speakers.

The case Dr. Long referred to can hardly be classed as Meckel's diverticulum, because the very definition of it shows something comes off from the small intestine and is the remains of the vitelline duct; therefore, it could not have any connection with the transverse colon. The condition he described is rare, but it does not go with the class of cases we have been considering.

Dr. Cullen has called our attention to a very wise precaution that should be borne in mind when we have evidence in a young child of the duct remaining open at the umbilicus as shown by the discharge of fecal matter or a serous fluid. It means there is a partially closed Meckel's diverticulum and the possibility later in life of producing obstruction. I do not believe it is wise to go down and cut about the umbilicus in these cases. We have at our hospital for the ruptured and crippled many hundreds of cases of herniæ in children every year. We have seen a good many cases, such as Dr. Cullen described, where a raspberry-like formation was present, and we have closed it by means of aseptic dressings and silver nitrate and have never operated on them. Diverticulitis is much more common in acute obstruction. Inflammation resembling appendicitis is much more common in acute intestinal obstruction due to strangulation such as I have described today.

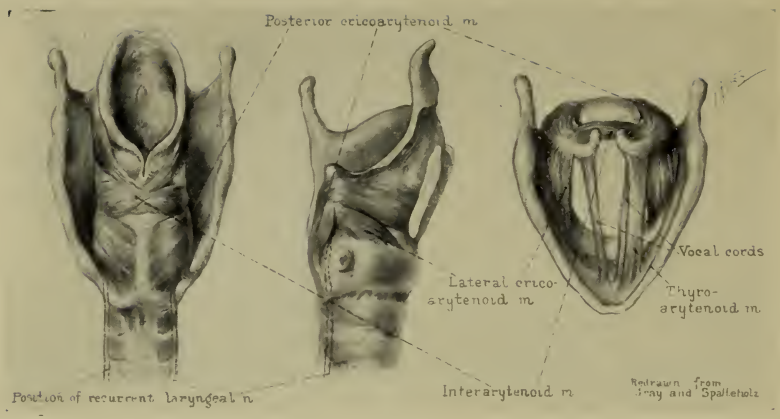

FIG. 1—Muscles of the larynx.

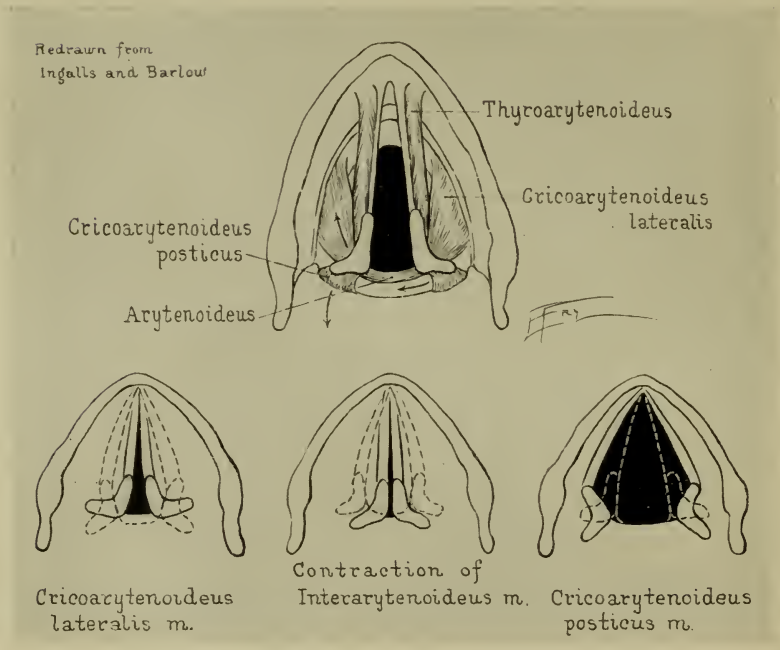

FIG. 2—Action of the muscles of the larynx.

LARYNGEAL FUNCTION IN THYROID CASES

By E. S. Judd, M.D.
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The larynx takes part in two functions, phonation and respiration. Phonation is brought about largely by the adductor muscles of the vocal cords, which in contracting approximate the cord in the midline. During normal respiration the vocal cords are held apart by the abductor muscles (Figs. 1 and 2). All the intrinsic muscles receive their nerve supply from the recurrent laryngeal nerve, and any disturbance in the function of the larynx is apt to be the result of some form of disturbance of this nerve. It is situated so that it is exposed to pressure from aneurysms in the upper portion of the chest and to pressure from enlarged lymph glands, and as a result of this pressure it is not uncommon for the nerve on one side to become partially or completely paralyzed. In the absence of any pressure or trauma this nerve may be paralyzed occasionally, probably as a result of some toxic influence. Because of the gradual onset of this form of paralysis the patient may not be aware of any change in the function of the larynx and may continue to speak and breathe in a normal manner. This is explained by the fact that as the muscles of one vocal cord become less active because of the interference to their nerve the muscles of the opposite cord increase their function, enabling the normal cord to make excursions across the midline of the larynx and approximate the cord at that point. So long as the change is brought about gradually the patient is not aware of it, but if one side is paralyzed

suddenly, loss of voice and difficulty in breathing will be experienced until, by repeated efforts, the muscles of the good cord bring it across to an exaggerated position. Matthews, working in our Clinic, several years ago found that a small percentage of patients on whom they made laryngoscopic examinations had almost total paralysis of the vocal cord and that in addition a larger percentage showed some paresis of one cord. This occurred in patients in whom there was no enlargement of the thyroid and who were totally unaware of any change in laryngeal function.

As the recurrent nerve passes upward in the groove between the trachea and the esophagus and reaches the region of the thyroid it becomes intimately associated with the posterior capsule of the thyroid gland, and in reality is compressed between the gland and the tracheal and cricoid cartilages. It can be seen readily that any enlargement in the thyroid is apt to make pressure on this nerve and that if the pressure becomes great enough it may cause disturbance in function. The size of the gland is not always accountable for the pressure, for there may be no sign of disturbance in the case of a large tumor and a marked disturbance may result from a small goiter placed so as to exert the greatest pressure on this nerve. Paralysis of the recurrent laryngeal nerve caused from a goiter apparently occurs in somewhat more than 5 per cent. of all patients with goiter. A very interesting condition occurs in a smaller percentage of cases, namely, a paralysis in the nerve on the side opposite the enlargement. A large adenoma of the right lobe may cause a marked displacement of the larynx and trachea, and if the proper amount of pressure or stretching is exerted on the opposite nerve, paralysis is produced.

When we realize that a certain number of persons without disturbance of the thyroid have paralyzed vocal cords, and also that a patient with goiter may have paralysis on the side opposite the enlargement, the importance of a careful

laryngoscopic examination before operation for goiter becomes evident. If a patient is depending on one cord for phonation and normal respiration it is important to protect that cord.

Total loss of voice in association with enlargement of the thyroid is due to one of two conditions, hysteria or carcinoma. At least I have not seen a case in which benign enlargement was the cause of bilateral paralysis. If the condition is due to hysteria some motion of the cords will be discernible with the laryngoscope; this motion is due to the adductor contractions; if the cords are completely paralyzed the condition is almost certain to be carcinoma. In benign enlargement we have to deal only with pressure and stretching of the nerve and with disturbances of the intrinsic muscle from these causes; in malignant disease the process is not confined within the capsule of the thyroid but involves the nerves and causes an actual destruction of nerve tissue, which results in a total paralysis.

Temporary disturbance in the voice and respiration is not uncommon following thyroidectomy (Guthrie). I believe that the loss of voice soon after operation may be due to one or more of the following factors: (1) A change in the position of the muscles and cartilages because of the shifting of a misplaced larynx back into its normal position; (2) edema of the tissues; (3) a true myositis; (4) trauma to the recurrent laryngeal nerve; and (5) prolonged interference with function.

1. *A Change in the Position of the Muscles and Cartilages Because of the Shifting of a Misplaced Larynx Back into Its Normal Position.* In several cases in which an adenoma was large and situated so as to push the larynx off at a right angle no view of the larynx could be obtained with the laryngoscope. I noticed that when the tumor was removed and the larynx allowed to return to its normal position the voice was lost immediately and returned to normal in from a few days to a few weeks.

2. *Edema of the Tissues.* This is more marked in some cases than in others, and is, I believe, less common now than formerly, because we realize the importance of keeping the line of dissection farther away from the trachea and larynx and of saving more tissues about these structures to prevent the swelling from extending to the mucous membranes.

3. *A True Myositis.* Myositis may result from trauma to the muscles and cause limitation of motion of the vocal cords, or any ankylosis of the joints between the cartilages of the larynx may occur. The delicacy of the laryngeal structures makes it impossible to determine just how often these lesions occur.

4. *Trauma to the Recurrent Laryngeal Nerve.* I am under the impression that the nerve is more often injured at the point of entrance into the larynx than at the point of crossing the inferior thyroid artery. The nerve is seldom severed, but it may be pinched in the hemostat with other tissue or it may be caught in a ligature in tying a vessel.

In 1997 Mann, New and I traumatized the laryngeal nerves in dogs to study the return of function. In 24 cases the nerve was pinched and all the cords were paralyzed. By pinching the nerve at the lower pole of the gland the function was restored in about sixty days; by pinching it close to the larynx, function was restored in thirty days. In all cases there was complete restoration of the laryngeal function. In another series of 19 the nerves were ligated. Plain and chromic catgut and silk for the ligatures were used, and in each instance immediate and complete paralysis occurred. These dogs were observed for one hundred and sixty days; during this time there was no sign of any return of function. In several instances in this series the nerve was severed, always with complete and permanent paralysis. In 9 of the series the nerve was stretched for a few minutes, but in 1 case only was there any paralysis from this procedure. In 4 cases the nerve was stretched by suturing

the muscles under it, thus producing a permanent constant stretching. In 3 of these paralysis occurred.

It seems to me that these experiments gave results that would be expected, that is, that if the nerve is severed or tied tightly, even with catgut, the ensuing paralysis will probably be permanent and the function will be disturbed until it can be compensated by the increased efforts on the opposite side. If the nerve is pinched or stretched or explored the paralysis will be temporary and the function restored by recovery of the traumatized nerve.

Injury to the superior laryngeal nerve naturally is an uncommon occurrence. This nerve supplies sensation to the mucous membrane of the larynx and a branch to the external muscles which, in contracting, make the cords tense. An injury to this nerve would produce a numbness in the larynx and a lax cord with a deep, coarse voice.

The complete restoration of phonation and respiration to normal occurs with restoration to normal of the muscle and cord on one side. Even if the nerve has been severed or destroyed completely, or if one cord has been removed, the function eventually returns, due to the compensatory efforts of the uninjured cord; so that while any trauma to a recurrent nerve is serious the effects so far as function is concerned will be only temporary. Serious results occur if the only nerve that is functionating is interfered with or if both nerves are traumatized. We have performed a great many thyroidectomies during the course of a number of years, and have observed many patients with some disturbance of phonation on respiration or of both at various periods, often within a few days after the operation, but the voice and breathing have always returned to normal except in a small group of cases. In a few instances some evidence of trouble persisted for a month or more, but finally ended with a normal laryngeal function. These patients are restored to normal voice through the increased efforts of the normal cord. In cases of paresis recovery occurs.

5. *Prolonged Interference with Function.* A small group of cases of bilateral abductor paralysis (12 cases) prompted this study of laryngeal function. The voices of these patients are usually normal or may be very slightly impaired; the principal disturbance is in respiration. In approximately 20,000 operations on the thyroid gland we have had 9 patients with this trouble; 3 others were observed who were operated on elsewhere. A few scattered cases have been mentioned in the literature. It is interesting to note that this condition has been observed independent of any condition of the thyroid, and in such instances was believed to be due to toxic influences (Gleitsmann).[2] Bilateral abductor paralysis is not uncommon with syphilitic and tabetic conditions. It is possible that some of the cases of complete dyspnea which occur at the time of the operation or a few days afterward are due to recurrent paralysis, although if the paralysis is complete there would be no trouble in breathing. These occurrences are rare, although at times they are severe enough to require immediate tracheotomy. After the acuteness of the symptoms has subsided, usually within a few days, the tracheotomy tube can be removed and the opening in the trachea allowed to close. The return to normal of the voice and respiration will take place in a short time. These cases may or may not be due to disturbance in the vocal cord, but the onset of the condition is so abrupt that no time can be taken for a laryngoscopic examination.

The onset in these 12 cases of bilateral abductor paralysis was gradual. The immediate convalescence from the operation in this group was not unusual except that the voice was weak and husky. In some of the cases there was paresis of the cord after the operation, although it was not sufficient to produce a noticeable change in the voice or in breathing except in two or three cases. In a few cases there was some hoarseness and huskiness immediately after the operation. At the end of four or six or even eight weeks

dyspnea appeared and gradually increased. The voice remained normal. The degree of dyspnea varied. Although usually a tracheotomy does not seem necessary, in 4 of these cases the margin of safety for a sufficient amount of air was considered so slight that operation was performed in 2 cases in the Clinic and in 2 elsewhere, 1 after six months, 1 after seven months, and 1 after fourteen months following the operation. The paralysis, if it is a paralysis, is confined to the posticus muscles, which are the abductors of the vocal cords. New has demonstrated that there is no ankylosis of the joints of the cartilages. We have not been able, however, to show that there is not a myositis in this muscle. The paralysis occurred for the most part in cases in which the adenomas were retrotracheal or retrolaryngeal, in which case the recurrent laryngeal nerve is liable to be in the field of operation; also, possibly in the removal, trauma occurred to the posterior tissues of the larynx. Although it seems that this condition must be the result of some change in the nerve to these muscles it is difficult to understand just how it can occur. Any manner of traumatizing the superior or inferior laryngeal nerve in dogs does not produce a condition anything like a bilateral abductor paralysis. Because the onset is late the explanation has been offered that the contraction of scar tissue produces pressure on the recurrent. This is entirely feasible since the fibers of the recurrent laryngeal nerve which supply the abductor muscle are known to be the most vulnerable part of the nerve. The condition, however, is bilateral and always of the same degree on both sides. In some of the cases almost all of the operative work was on one side only, so that there was no chance of trauma to both nerves, and it seems unlikely that the same amount of scar tissue should occur on each side. New has suggested that at the time of the operation injury to the nerve may be serious enough to produce interference with abduction and with adduction (the immediate disturbance in the voice in all but one case bears this out),

and that the nerve recovers partially so that the voice becomes normal, but that the portion of the nerve which has to do with breathing does not recover.

The recurrent laryngeal nerve is a pure motor nerve coming from the vagus. It is small, but in spite of this can be separated into two distinct bundles of fibers (Russell). One of these bundles supplies the muscles of adduction and the other the muscles of abduction. These fibers run in separate bundles throughout the whole course of the recurrent nerve; those for abduction are on the inner side of the nerve trunk and those for the adduction on the outer side. They may be dissected to such an extent that one set of fibers responds to electric irritation exclusively by adduction of the vocal cords and the other by abduction. Rosenbach was the first to proclaim that the abductors suffer first from compression of the recurrent nerve. Semon proved, however, that the important pathological condition is seen not only in local lesions along the cords but also in central cerebral diseases as well as in spinal diseases of an organic nature. Grabower found that the posticus muscle has on the average 281 terminal nerve fibers and the adductors have 680, and he believes that this may explain why the abductor muscles are the first to be affected. If it could be explained how the scar tissue affects both nerves in exactly the same way the contraction of this tissue on the recurrent laryngeal nerve might explain the condition, especially in view of the fact that the onset is gradual. If it is due to the contraction of scar tissue it is difficult to explain why it is not much more often seen. We have been unable to simulate the condition experimentally. It is entirely possible that it is the result of some toxic influence on the nerve, and yet it is hard to explain why such a small percentage of cases are influenced by it. In the few cases we have seen it has usually occurred in patients with non-toxic goiter so that the toxemia of hyperthyroidism could hardly be responsible.

Discussion. Although cases of bilateral abductor paralysis following thyroidectomy are extremely rare, they are so serious that they deserve a great deal of consideration. We have observed that the condition progresses until there is considerable difficulty in breathing, especially on exertion, and from then changes are slow. In none of our patients has phonation been affected except from dyspnea; after a long time the tendency seems to be toward improvement.

Tracheotomy may be necessary because of the small margin of safety, although so far as we have been able to determine there is no danger of acute suffocation. The cords are held in adduction by the contraction of the adductor muscles, and it is probable that these muscles would relax enough to allow the entrance of air in case of any suboxidation.

For the treatment of these cases other than tracheotomy we have considered the advisability of dissecting the recurrent laryngeal nerves from the scar tissue, in the hope that by freeing them the pressure of the contracting scar might be relieved and enable the nerve to functionate normally. We have also considered performing a plastic operation on one vocal cord in order to give more breathing space, but we have hesitated to do this because of the fear of interfering with the voice. Usually when this is explained to the patient he prefers not to take any chance on having phonation disturbed.

It may be said, in conclusion, that: (1) The functional results following thyroidectomy both as concerns phonation and respiration are extremely good; (2) the disturbance which sometimes follows immediately after the operation is temporary and normal function will be restored in from a few days to a few weeks; and (3) there is a very small group of patients who, following thyroidectomy, have a bilateral abductor disturbance which is slow in onset but is very persistent. We have been unable to work out the cause of this condition, but believe that it may be due to the con-

traction of a scar, to a peculiar type of trauma to the nerve, or to some form of toxemia.

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DISCUSSION

Dr. George W. Crile, Cleveland, Ohio.—Dr. Judd has summed up nearly all the points of interest and there is nothing in his paper to which I cannot subscribe. Originally we followed Kocher's method of removing the large lobe of the goiter and leaving the other lobe. This was objected to by our patients and that plan was abandoned. Then we tried the plan of leaving a portion of the upper lobe and a portion of the lower lobe on each side, and that was objected to because in some cases it left unevenness of the neck. During this time we had less disturbance of the voice after the upper and lower lobe resections. Then we tried the plan of clamping the upper and lower lobes with large forceps, grasping the vessels on both sides and dividing them, but we found that large forceps would make traction on the recurrent laryngeal nerve, which was complained of immediately by the patient. In all these cases we used analgesia during the operation and were able to talk to the

patient during the operation. We found that a small amount of traction on the nerve, even if the nerve is not included in the forceps, caused more or less interference with the voice. We, therefore, stopped using large forceps and stopped most of the clamping. In order to guard ourselves against the danger of interfering with the recurrent laryngeal nerve, the danger of interfering with the blood supply and the danger of removing the parathyroids we introduced sharp knife dissection, making the division within the bloodless zone. We found that we could then see the parathyroids and the recurrent laryngeal nerve, and could be sure that we did not interfere with these structures. However, instead of getting better results we had the worst results we ever had in these cases. We did 200 of these operations by this plan and then dropped it, for although the patient came through the operation all right, progressive interference with the voice developed later. We therefore dropped that operation and now for a long time we have used the more laborious method described by Dr. Judd. As he has said, when immediate contact with the surface of the larynx is avoided there is less reaction after operation and less edema.

For a long time we have used smaller forceps in making the dissection, leaving a sufficient lateral margin of thyroid gland tissue to cover the parathyroid and superior laryngeal nerves on each side. The dissection is carried from above downward, grasping the branches and not the trunk blood supply of the superior and inferior thyroid arteries. This method requires a much more careful technic, but it leads to no stretching of the recurrent laryngeal nerve. It does not expose the nerve, and normal thyroid tissue with the normal capsule intervenes between the parathyroids and the recurrent laryngeal nerves. In the last 500 cases the whole operation has been performed under analgesia and the patient has talked during the operation. During that time we have found that the slightest interference with the larynx or trachea by traction on the larynx or trachea makes the patient talk. I did not suppose that slight traction would interfere with the voice, but it does. The recurrent laryngeal nerve is highly sensitive. Furthermore, we were obliged to perform a tracheotomy in one case. We have used our finger on the outside of a large bilateral goiter in dissecting the upper lobe and then turned out the upper lobe on the opposite side in the same way by passing a finger behind the gland and turning it into the field. Some of these glands meet behind the

larynx and esophagus, and it is better not to make even a temporary pull on these nerves.

Dr. A. J. Ochsner, Chicago, Illinois.—The paper of Dr. Judd covers the whole field and will serve as a guide for future surgeons as regards these forms of operation for goiter. Some years ago in studying the literature of this subject I found there was a very great difference in the number of cases of paresis involving the recurrent laryngeal nerve following thyroidectomy in different clinics. In some clinics there was as high as 50 per cent. of disturbance. In most cases the disturbance was very slight, but it was sufficient to be recognizable. In trying to determine why these clinics had a much higher percentage of disturbance in cases operated on for goiter than in other clinics, I studied the methods employed, and then it occurred to me that in those clinics in which the greatest amount of care was taken against injuring the recurrent laryngeal nerve, where it was carefully exposed so that it would not be injured, there was a very high percentage of paresis. In these clinics the recurrent laryngeal nerve was exposed at the point where it crosses the inferior thyroid artery, and then it was kept in view throughout the operation, so that it could not be injured. The reason why in this type of operation they should have had so much disturbance came from the fact, as Dr. Judd has pointed out, that a very slight amount of irritation to the nerve, either from pulling or from touching it, or later from scar contraction, was sufficient to bring on this disturbance. As a result of that observation we have followed the plan Dr. Judd recommends of leaving enough gland substance in front of the recurrent laryngeal nerve so that we do not get near this structure.

We are doing practically all of our thyroidectomies under novocain local anesthesia. During the operation we have the patient not only speak when there is any doubt, but cough; because a patient can speak but he cannot cough in an abnormal way, so that we can tell whether we have gotten too close to the recurrent laryngeal nerve.

The other point is this: We clamp all vessels and leave the forceps in place, and having removed as much of the gland as we desire, instead of meddling with the little points of oozing, we now pack the whole surface behind the anterior muscles with a piece of gauze and leave that in place until we have ligated

all vessels, which takes a few minutes, and during that time pressure has stopped this oozing.

Dr. E. G. Jones, Atlanta, Georgia.—Following the excellent teaching of such men as Dr. Ochsner and Dr. Crile, the very thing I try not to see in the operation is the recurrent laryngeal nerve. I have heard no reference made to an occurrence which has attracted my attention more than once, namely, the sudden restoration of phonation. My own experience has been limited to three patients in whom the voice was reduced to a complete whisper for some time following operation. Two of these patients recovered their voice rather suddenly. One intelligent woman, having had aphonia for four or five weeks, on being told that she would ultimately recover her voice, placed confidence in the statement of the physician, and finally her voice became practically normal in a few days. My experience with the first one of these patients was such as to frighten me very much. The patient was a colored woman. Three months following operation she still had complete aphonia. I was very much discouraged, but one day, when her child was standing in front of the house, she saw a horse running down the road in his direction, and being afraid the child would be injured, she shouted aloud. Immediately she found that she had recovered her voice and has had no difficulty since.

Dr. Judd (closing the discussion).—We certainly owe to Dr. Crile, to Dr. Ochsner and to Dr. Charles H. Mayo all we know concerning the technic of thyroidectomy. In performing thyroidectomies we are all keeping farther away from the recurrent laryngeal nerve. This means saving more than formerly of the posterior capsule. It means saving the thyroid tissue with the posterior capsule and being sure not to traumatize the recurrent laryngeal nerve. Regarding the point brought out by Dr. Jones, I have had the same experience of the patient's sudden return of voice. This may be explained by the fact that the loss of voice immediately follows injury to one or both cords, and the voice returns just as soon as the cords are approximated.

CLINICAL AND EXPERIMENTAL OBSERVATIONS IN THE USE OF SALINE IRRIGATIONS IN THE TREATMENT OF DIFFUSE PERITONITIS.

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If one may judge from the published statistics of the various clinics, surgeons can view with pride the reduction of the mortality accompanying diffuse peritonitis. According to Douglas,[5] in the period from 1888 to 1904, in the hands of the foremost American and foreign surgeons, 65 per cent. of such patients succumbed; while the mortality for the years 1900–1904 inclusive was 55 per cent. Murphy,[13] in 1908, was able to report the astoundingly low mortality of a little more than 4 per cent. Undoubtedly, several factors have contributed to effect this improvement in the results, and some of these measures have come to be so generally accepted and practised in the treatment of diffuse peritonitis as to justify scarcely more than their mention.

In this class we can place early operation. There is no question that this factor alone is sufficient to explain fully the differences in the earlier and more recent statistics; for it is a well-recognized fact that a frail patient operated within a few hours after the perforation of an ulcer or the rupture of an appendiceal abscess is a far better risk than a robust patient at the end of forty-eight hours, irrespective of what procedure is adopted at the operation. This is particularly significant when it is learned that all of Murphy's patients

were operated upon in less than forty hours, and this author emphasizes the desirability of even earlier operation.

In the same class is to be placed the free use of water or salt solution by rectum. There are, indeed, few surgeons today who do not consider this measure of the greatest importance in the treatment of patients suffering from any severe septic condition, and it seems particularly appropriate in reference to peritonitis where dehydration is the rule. I believe, however, that it is not sufficiently appreciated that even better results may be obtained by the use of the subcutaneous injection of normal salt solution in addition; for by this way, more rapid and larger absorption may be obtained, and we are not dependent upon the troublesome and uncertain proctoclysis.

Concerning other details of treatment, however, surgeons are not in such perfect accord. Thus, we find that there are those who do not favor the use of opium; some even going so far as to advocate the use of purgatives. In regard to posture also, there is a difference of opinion, some contending that absorption is delayed and the condition of the patient improved by the use of the head elevated position. It would be interesting to include in the discussion a consideration of these points, but at this time I am particularly concerned with the status of another debatable procedure; namely, the irrigation of the peritoneal cavity in the presence of a diffuse peritonitis.

According to some authors, the use of the adjective "debatable" in regard to the employment of irrigation in peritonitis is scarcely permissible, for they deem that the epoch-making paper of the late J. B. Murphy[13] closed the debate upon this subject. Thus, Hertzler[9] states: "Many have opposed it, and since Murphy excluded it from his method of treatment, it is but seldom used." With due consideration for the eminence of the opponents of this procedure, it does seem that, in their enthusiasm, they have overlooked the names of some surgeons who are entitled to a hearing; for such men as

Mikulicz, Kammerer, Hartwell, Moynihan, Senn, Blake, Bevan, and Mumford, have advocated irrigation in the presence of a diffuse process. For the proper decision of a matter which may be of vital importance to our patients, however, we should be influenced not so much by the unsupported statement of a leader, no matter how eminent his position nor how emphatic his words, but by the logic of the arguments, and, even better, by the presentation of supporting evidence. There is, I believe, still too great a tendency among many members of the medical profession to accept passively what is advocated by the recognized leaders in the profession and to disregard the fact that these men are no more than mortal and share the common fallibility of mortals.

Let us consider the objections that have been raised against the use of saline irrigation in the presence of diffuse peritoneal infection:

First, it tends to produce shock by subjecting the patient to a longer operation.

Second, it traumatizes the peritoneum and accelerates absorption.

Third, it washes off the defensive phagocytes and removes the protective exudate. According to Murphy:[13] "Washing removes the pus with its myriads of leukocytes, sent there for the sole purpose of protection." In reference to the peritoneal fluid, he says: "There can be no doubt that this fluid, small in amount though it is, has great bactericidal properties; it is increased greatly both in quantity and bactericidal potency even very early in peritoneal infections." Hertzler[9] also expresses similar views, saying, "Much harm is done also by removing the natural defensive forces of the tissues. The exudate covering the surface of the peritoneum is composed of serum and cells and in just the measure that irrigation is effective it is harmful by removing this protective measure."

Fourth, it spreads infectious material from the primary

focus to areas of the peritoneum that had not previously been involved. It is probable that no operable case ever showed a true "general" peritonitis; at most, the process is a "diffuse" one and there are certain portions of the peritoneum which are not the seat of actual inflammatory changes. Murphy has pointed out that colon bacilli are constantly present in the immediate vicinity of a perforation, while cultures taken from more distant portions of the cavity may show only the presence of the harmless staphylococcus albus or, indeed, be actually sterile. Therefore, he contends that flooding the cavity with salt solution serves to sweep the colon bacilli to these hitherto uninvaded regions.

These objections may appear to constitute a severe indictment against the practice of peritoneal irrigation, but a closer analysis reveals that the basis upon which they rest is more fancied than real. It is indeed true that long exposure of the intestines to the air with the resulting drying joined to the trauma of excessive handling will give rise to a condition similar to surgical shock. Prolonged etherization, also, as I have been able to demonstrate, will much reduce the resistance of animals to intraperitoneal infection, but these factors are by no means necessitated in employing irrigation clinically. As Reichel[14] first pointed out, and as has been confirmed by Murphy and Buxton, overwhelming toxemia may produce a condition closely simulating shock; and I am inclined to suspect that the added few minutes demanded by irrigation is less apt to cause this so-called shock than is the hasty, ill-executed operation performed in accordance with a too literal acceptance of the dictum: "Get in quickly, get out quicker." Impressed with the desirability of excessive speed, the operator is apt to leave in the peritoneal cavity bacteria, toxins, and material which will serve as culture medium for the bacteria, with the result that the shock-like toxemia takes place.

Wegner[18] first showed the influence of injecting albuminous material along with the bacteria and Grawitz[6] emphasized

the great increase in the virulence of the organisms produced by the simultaneous injection of such substances as blood clot, agar, or gelatin with the bacteria into the cavity. Similar observations have been made by Waterhouse,[17] and Halsted.[7] Murphy[13] recognized the possibility that the presence of foreign material in the peritoneal cavity may act deleteriously; because he makes the following statements: "Many microörganisms injected into joints without foreign bodies produce no inflammatory reaction, while the same culture injected with foreign bodies produce violent synovitis;" again: "The introduction of bacteria into the peritoneal cavity is not sufficient to produce peritonitis if the membrane be healthy and free from foreign bodies." If one accept the view that foreign matter in some way enhances greatly the virulence of bacteria in the peritoneal cavity, it is hard to understand why the importance of its removal be not readily granted. The more I see of diffuse peritonitis, either as produced experimentally or as it occurs clinically, the more I am impressed with the fact that speed, however desirable, should not be obtained at the expense of methods that leave in the peritoneal cavity extravasated intestinal contents, and countless unabsorbed bacteria and their toxins.

As to the second point, namely, that irrigation traumatizes the peritoneum and accelerates absorption, it is probable that both contentions have no basis. It is indeed hard to conceive how irrigation properly carried out will traumatize the peritoneum. There is no question but that the older methods, where a hypotonic solution of simple boiled water or, even worse, a strongly irritant antiseptic was used, often along with vigorous sponging and eventration injured this delicate membrane; but when one fills the cavity and covers the intestines with warm, isotonic salt solution and is careful to avoid mechanical insult to the tissues, it would seem that there is far less tendency to "trauma" than when the intestines are exposed to the drying influence of the air Wegner[18] has shown that exposure of the intestines to dry

air is followed by a paralytic ileus and collapse of the animal, while, on the other hand, the same operative procedures, with the exception that warm, moisture-laden air was passed over the intestines, was followed by no disastrous consequences. Proper technic, therefore, should cause no excessive trauma, but that trauma is conducive to increased rapidity of absorption seems open to question. If the peritoneal membrane plays the role of a passive filter, injury to or destruction of the constituent cells will accelerate filtration; but, if these cells possess a secretory power similar to those of the kidney, injury to them will lessen their activity. I do not contend that absorption from the peritoneal cavity is accomplished through vital activity of the cells, but the reverse has not been proved and should not be assumed.

It must be admitted that irrigation to be effective removes the greater part of the peritoneal exudate. At the onset, the exudate is undoubtedly possessed of defensive properties, but is this true of it at the time of operation? Would any surgeon be willing to inject a considerable amount of the exudate from a patient suffering from a severe peritonitis into another patient with the object of conferring a passive immunity upon this second patient? It would seem that statements such as those made by Murphy and Hertzler are based upon rather faulty reasoning; impressed by the fact that this exudate originally contained phagocytes and unformed defensive products, these authors have apparently forgotten that later in the disease it teems with virulent bacteria. Moreover, as recently emphasized by Hughes,[10] as the disease progresses the vitality of the phagocytes decreases and the defensive substances are replaced by bacterial toxins, so that the originally protective fluid becomes nothing more than a toxin-laden culture medium for the pathogenic organisms acting like the "foreign bodies" so dreaded by these authors. It is interesting to note that Mikulicz observed an increased production of phagocytes following the introduction of salt solution into the peritoneal

cavity; so that instead of decreasing the resistance of the peritoneum by robbing it of the exudate it is possible that the powers of resistance are actually heightened.

The possibility of spreading through irrigation virulent bacteria to uninvolved portions of the peritoneum is a point to be carefully considered. No one advocates irrigation of the uninvolved peritoneum in the presence of a definitely walled-off abscess. Even the staunchest supporter of free irrigation reserves this measure for those cases where there is reason to believe that we are dealing with a diffuse process. Since in these cases there is always at some stage more or less free fluid in the cavity, it is difficult to understand how the contact of this fluid in the cavity is limited to either the sound or diseased peritoneum. In view of this difficulty, it appears that the sterile saline can scarcely be more active in disseminating the infectious material. Either fluid is capable of carrying bacteria in suspension to distant parts of the peritoneal cavity, but the defensive powers of the tissues in these regions is sufficient to enable them to overcome the infecting organism. Negative cultures do not prove that these regions were *uninvaded*; all that they show are that they are *uninvolved*.

What may be said in favor of the use of free irrigation with normal salt solution in appropriate cases?

First, contrary to the views that its opponents have advocated, it lessens the tendency to shock. This is accomplished by preventing undue loss of heat through the use of a solution slightly above body temperature and also through the prevention of drying of the exposed intestines.

Secondly, it washes out mechanically a certain number of unabsorbed bacteria, and, at the same time, fibrin, pus, blood clot, or intestinal contents which may serve as "foreign material," facilitating the growth of the bacteria. As has been previously mentioned, Grawitz,[16] Reichel,[14] Waterhouse[17] and Murphy[13] have indicated the importance of such foreign matter in the genesis of infection. The three first-named

authors have shown that the intraperitoneal injection of aqueous suspensions of bacteria were not productive of results, while similar doses of bacteria accompanied by pus, gelatin, agar, or, especially, blood clot uniformly gave rise to a peritonitis.

Third, it serves to dilute those toxins which are not removed at the time of operation. Unless removed these must be destroyed in the tissues or eliminated unchanged, and, if one be permitted to reason by analogy, dilution will markedly lessen their injurious action. Kleiner and Meltzer[11] have shown that dilution greatly reduces the toxicity of strychnine when that drug is injected into animals; and the same principle has been shown by Hatcher[8] and his co-workers to apply to certain of the local anesthetics. These latter experimenters found, for example, that when small, repeated doses of novocain are injected into cats, more than twenty times the dose, almost invariably fatal when given quickly, would be survived. If dilution thus lessens the toxicity of strychnine and novocain, it is probable that it would similarly lessen the toxicity of bacterial poisons.

Finally, the peritoneum is an absorbing surface of great activity. Attention was first directed to this by Wegner[18] and it has been emphasized by Clairmont and Haberer,[13] Schnitzler and Ewald,[15] and Dandy and Rowntree.[4] These last-named authors have shown that phenolsulphonphthalein appears in the blood within two minutes after its introduction into the peritoneal cavity of dogs, and that at the end of an hour, from 40 to 60 per cent. of the injected dye had appeared in the urine. Pediatricians have recognized the value of the intraperitoneal administration of fluid, and it is now a frequent procedure in cases of infants suffering from excessive water loss.

These arguments, based upon theoretical considerations, do not, I believe, tend to show that irrigation of the peritoneal cavity in the presence of a diffuse peritonitis is a reprehensible procedure. Actual results, however, as I have already

pointed out, should influence us in making a decision rather than these theoretical considerations, no matter how logical the latter may seem.

It requires the utmost caution not to be misled by clinical results. The surgeon does not employ a single procedure in the treatment of his patient and it is difficult to know which one is most active in effecting a cure. With each case, the conscientious physician is concerned primarily in effecting a cure and only secondarily with determining the efficiency of the various procedures adopted. It would seem, therefore, that by means of animal experimentation, where the conditions may be more accurately controlled and where the recovery of the animal is inimportant the most valuable information could be obtained.

The attempt to learn through animal experimentation the value of irrigation in the treatment of peritonitis has not been lacking. Reichel,[14] is an excellent paper, publishes the reports of experiments which seem to indicate that irrigation was not only useless, but actually did harm. Clairmont and Haberer[3] were unable to save any animals that had received a fatal dose of bacteria intraperitoneally, though irrigation was practised in some cases within a few minutes after the injection of the organisms. They did find, however, that by means of irrigation, animals could be saved from otherwise fatal doses of toxins which had been injected intraperitoneally. Witzel[19] also concluded that irrigation was of value, but, unfortunately, he gives no details of his experiments. Trzebicky[16] states that irrigation was effective in saving seven out of eighteen dogs, while the control dogs all died.

During the past fifteen months, I have endeavored to secure additional information as to the probable value of irrigation in the treatment of peritonitis. In spite of the fact that I have used over two hundred and fifty dogs during this period, I cannot say that the question has been definitely answered.

The production of an experimental peritonitis at all com-

parable to the condition encountered clinically is practically impossible. Reichel[14] has emphasized this fact, declaring that there results either a comparatively mild disturbance from which the animal will recover; rapid death with no demonstrable changes in the peritoneal cavity; peritonitis with a hemorrhagic exudate and early death; while only rarely is there seen the more prolonged peritoneal involvement seen in human beings with its purulent or sero-purulent exudate. These statements I have been abundantly able to confirm; as well as his observation as to the enormous variation in the resistance of different dogs. The details of these experiments will be published elsewhere; it is of interest, however, to review the results briefly.

The ideal as I saw it was to produce in dogs a peritonitis which would always cause the death of the animals unless appropriate treatment was instituted; and then to ascertain the value of the two methods of treatment; namely, either rapid incision and drainage, with repair of any wound that existed; or, the use of irrigation with normal saline in sufficient amounts to wash out exudate and detritus. In the cases where irrigation was employed, drainage was seldom used; and in the cases treated without irrigation, the best results were obtained in those where drainage was omitted. This is mentioned as an interesting fact; it does not prove that the drainage was injurious or could be safely dispensed with.

It was soon found that this ideal was unobtainable. The resistance of different dogs varied to such an extent that a procedure which would cause the death of certain highly resistant animals was so rapidly fatal to the average animal as to render any treatment useless. It was necessary to be content, therefore, with a procedure which gave rise to a peritonitis fatal to the great majority of untreated dogs, and, subjecting all of the animals to this procedure, to ascertain the number of survivals in the three different series; controls, non-irrigated, and irrigated.

The attempt was first made to produce the peritonitis by

injecting pure cultures of different bacteria intraperitoneally. Whether these were in bouillon or gelatin, a fatal peritonitis could scarcely ever be produced, and even the simultaneous injection of blood clot or fecal suspension was generally unsuccessful in accomplishing this end. Recourse was next had to incision of the colon. At first, this was done by thrusting the knife through the wall of the colon, as low in the pelvis as could be conveniently reached.

The peritonitis produced in this way, however, ran a very irregular course, many of the untreated controls surviving. The inclusion of the results of these experiments here would only confuse, so an analysis of them will be withheld until the appearance of the more detailed paper. A more virulent disease was produced, however, in the following manner. The exudate removed from a dog succumbing to a fatal perforative peritonitis was injected intraperitoneally into other dogs and by successive passage, its toxicity was greatly enhanced, according to the method of Burginsky.[1] If this enhancement were carried too far, the virulence became so great that all animals died regardless of the method of treatment. Many experiments were necessary, therefore, before an exudate of satisfactory strength was secured. Bacteriological examination of this exudate in three instances was kindly made by Dr. S. W. Budd, and Bacillus coli was the only organism recoverable. The same finding was made in the heart's blood from one dog succumbing to the infection. It is possible that other organisms were associated with the colon bacillus, but were overgrown by the latter. Five different exudates were used with fairly satisfactory results. Grouping all of these together, we found that the animals treated by irrigation had the lowest mortality rate. The results of the experiments are given below.

Method of treatment.	Mortality.
Incision and drainage	100.0 per cent.
Controls	89.1 "
Irrigation	78.9 "

Even with a highly virulent exudate, certain of the untreated controls survived. The attempt was always made to use the animals in worst condition for irrigation, and it was found that the initial leukocyte count and its behavior following the injection of the exudate gave some information as to the prognosis. Thus, a dog with a high initial white count and responding by an increase in the leukocytes following the injection was found to be more resistant than one with a lower count and a poor response on the part of the leukocytes following the injection. When it is realized, then, that the dogs subjected to irrigation represent the poorest risks, the figures assume an added importance and speak strongly in favor of this procedure. The adoption of the "get in quickly—get out quicker" method was particularly disastrous; not only did all of the animals so treated succumb, but their duration of life was distinctly lessened. This, I am convinced, was due to the etherization, but in spite of this factor, the mortality percentage of the irrigated animals who had ether is lower than that of the controls.

In estimating the value of the reports as to the number of recoveries following operation for diffuse peritonitis, it is necessary to know what is meant by the term "diffuse peritonitis." Unfortunately, there is lack of agreement as to what constitutes a diffuse process; one surgeon so designating a condition which a second operator will feel to be an instance of localized infection. It is to be regretted that there are no definite criteria which may be used to determine the gravity of a peritonitis as we encounter it, but the following points are certainly of much assistance in arriving at a conclusion as to this:

1. The genesis of the peritonitis; whether it arise from a stab or gunshot wound, perforated ulcer, or ruptured appendix.

2. The number of cases of "diffuse peritonitis" in proportion to the total number of cases seen by the surgeon.

3. The lapse of time which has occurred since the onset of the symptoms.

4. The general appearance of the patient, the character of the pulse, and the nature of the abdominal resistance.

Finally, the appearance on opening the abdomen.

A very frequent cause of fatal peritonitis is a ruptured appendix or appendiceal abscess. From an examination of the mortality statistics for the State of Virginia, it would seem, from a conservative estimate, that over 500 persons died during 1919 from appendicitis. In the registration area of the United States, comprising about 75 per cent. of the population, 9941 deaths were reported as due to appendicitis during 1918, while peritonitis was responsible for 1858. Undoubtedly, many patients succumbed to peritonitis masquerading under a diagnosis of "acute gastritis," or where death occurred with no attending physician. Moreover, it is probable that the course of the disease in different patients when a common cause exists will follow more nearly similar lines than where cases due to diverse causes, such as wounds or ulcer perforations, are included. Therefore, in the present discussion of peritonitis, I shall limit myself to a consideration of those which have originated as the result of appendiceal rupture.

During the past twelve years and a half, there have occurred in my practice 1031 cases of acute appendicitis. In the same period of time, we have encountered 33 cases that we considered instances of true, perforative, diffuse peritonitis. Therefore, the cases of peritonitis constitute a little more than three per cent. of the total number of acute appendix cases, a ratio which I do not believe too high when it is appreciated that 85 per cent. of my practice comes from the rural districts and is subjected to the usual delays, rough travel, etc.

The condition revealed on opening the abdomen is, I believe, the best guide in determining the extent of the process. Certainly, in my experience, a satisfactory examina-

tion through the small incision advocated by the supporters of the "get in quickly—get out quicker" plan is difficult or impossible.

So far as the aim of this paper is concerned, it is fortunate that my cases of peritonitis can be divided into two series. During the first five and one-half years of the period mentioned, 14 cases of peritonitis and 460 cases of acute appendicitis were operated upon. In the past seven years 19 cases of peritonitis and 571 cases of acute appendicitis were treated. Gastric lavage, opiates, and the free use of salt solution by rectum and subcutaneously were used in both series; indeed, the treatment in both periods was identical with one exception. In the earlier series, the principle of rapid operation with a minimum of intra-abdominal manipulation was practised. Of the 14 patients, so treated, 7 succumbed, giving a mortality of 50 per cent. The second series was made up of 19 patients, 18 of whom were treated by free incision, the opening of all pockets, and combined irrigation with normal saline and the use of a Pool, water or electric suction apparatus. The technic I employed did not cause unnecessary trauma to the peritoneum, and with the use of the suction apparatus, it was little more time-consuming than the operation where irrigation was omitted. Of the nineteen patients seen, three died.

It is interesting to review briefly the histories of these three fatal cases. The first, No. 6, in the last series, was a girl of sixteen, who came to the hospital practically moribund, dying in three hours. Ill ten days, she was being brought in to be operated for appendiceal abscess, but rupture of the abscess occurred on the train, and so rapidly was she overcome by the toxemia that operation was refused. I have always regretted the course followed by me in this case, because, subsequently, cases apparently fully as serious, responded favorably to irrigation.

The second fatal case, No. 15, of this series, occurred in a boy of seventeen. Ill seventy-four hours, severe diffuse

peritonitis was revealed at operation, but he convalesced rapidly. Distention disappeared entirely, bowels moved spontaneously, and he was receiving general diet. Right-sided empyema developed on the tenth day and death occurred four days later.

The third case was in a boy of twelve, No. 19, of the series. Duration of illness was sixty-six hours. On entry, heart rate obtained with stethoscope was 176; temperature, 99.5 F. The clinical appearance suggested overwhelming toxemia. At operation, there was disclosed a perforated appendix, generalized redness of the peritoneum with very little exudate. Culture revealed the presence of streptococcus. Death occurred thirty-six hours after operation.

Including the patient who was denied operation, the mortality in the series treated by irrigation was 16 per cent. as compared to 50 per cent. in those treated by the "get in quickly—get out quicker" method. So far as I could determine, the patients in the irrigated series were fully as ill as those in the non-irrigated, and, in my hands, I am convinced that the same high mortality would have resulted had irrigation been omitted. Aside from the reduction in mortality, I attributed to the use of irrigation a shorter and smoother convalescence and a lessening of the importance of drainage and the Fowler posture.

In the face of this evidence, is it logical to consider that irrigation is a procedure so fraught with danger to the patient? With a full realization of the adverse views held by many I wish to state that my clinical experience and many facts of animal experimentation indicate to me strongly that this measure is of value in the treatment of progressive diffuse peritonitis, and I am convinced that it enabled me to save patients who would otherwise have succumbed.

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SURGERY OF THE GALL-BLADDER

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With the exception of the appendix, no organ of the abdomino-pelvic cavity, common to both sexes, is so frequently involved in a chronic inflammatory process as the gall-bladder. While the title of this paper calls for a somewhat complete review of all surgical procedures upon this viscus, I beg your indulgence in limiting it to the consideration of operative cure or relief of inflammatory lesions.

Probably no inflammatory process of an abdominal viscus is oftener overlooked or passes undiagnosed for so long a time as that of the gall-bladder; yet there is no other condition which calls more urgently for early surgical intervention to cure and, more especially, to prevent serious later consequences. Among those doing a considerable amount of gall-bladder surgery who is there that can state that a proper proportion of the second and third decade cases are referred to them by the internist for surgical treatment? Is it not a fact that the gall-bladder sufferers, which reach the surgeon's care, come as a rule in the fourth, fifth, or sixth decade and then not until a serious block with severe local symptoms necessitates?

It is always interesting while taking the history of these late cases to find that the patient has for many years been suffering from and treated for toxic disorders and reflex disturbances which were finally recognized as due to the gall-bladder because of cystic or common duct block. All of this intervening time the large majority were told they suffered

from nervous dyspepsia, starchy indigestion, intestinal indigestion, constipation, biliousness, kidney disease, poor circulation, anemia, and other as indefinite disorders, and were treated with an empiricism on a par.

The question naturally arises, why is this the case? In answer it may be said there is a two-fold reason. First, as stated before, a diagnosis is too often not made in the early stages of the disease; secondly, when a correct diagnosis is made in the absence of distinct, painful block, there still lingers in the minds of the medical men the belief that dietary care and certain chemic agents administered internally will effect a cure. The cholagogues (broken doses of calomel, blue flag, or wahoo), biliary antiseptics (sodium salicylate or succinate), stabilizing bile salts (taurocholate and glycocholate of sodium, which are supposed to prevent precipitation of cholesterin), mild cathartics and olive oil, associated with pepsin, pancreatin, strychnia, bitter tonics and what not, are given the sufferers until a distressing local pain necessitates the help of the surgeon.

Are we to live through twenty to twenty-five years of ill-defined indications for treatment of the inflamed gall-bladder which shall correspond to the history of the inflamed appendix through a like period of time? Will it take this long to impress upon the internist and to teach the layman that the best time to resort to surgery is the earliest possible moment after the recognition of the disease?

Possibly, and this we must recognize, the surgeon has played a part in this uncertain acceptance of early surgical intervention because no clear and well defined law has been generally adopted by him. Many surgeons are even in this day loath to remove a gall-bladder which does not present decided gross pathology for fear of criticism, even though they know the gall-bladder is involved and symptom-producing. As long as this attitude is taken by surgeons, so long will it of necessity cause others to hesitate to resort to curative surgical measures.

Fortunately, the pathology of inflammation of this viscus and its late consequences have been so very well worked out there is no longer occasion for uncertainty. In the days when the typhoid and colon bacillus and other microörganisms were supposed to precipitate cholesterin from the bile by splitting up the biliary acids which hold it in solution and cause trouble only through stone formation; or it was thought that the nature of a diet possibly determined this precipitation and that the amount of water drank necessarily governed the concentration of the bile, the conception of when and what to do surgically was fairly simple. The removal of the stones, drainage and a simple diet fulfilled every requirement. But now that the sequence of pathology is better understood, it seems there should scarcely be any doubt as to when surgery should be called upon to treat these cases, nor as to what should be done.

I believe it is fair to state that in the early period, when no prohibitive coincident malady exists, the removal of the gall-bladder is not only justifiable, but should be done by the surgeon. In the later period when gall-stones or chronic inflammation obstruct the flow of bile there can still be no question as to the advisability of a radical procedure, conjoined always with careful exploration of the common duct insuring its patulousness.

In the last stage of the disease, however, each case must become individual. In an old common duct block from stone, associated with a marked myocardial and vascular degeneration; or in one where cicatricial block of the ducts has resulted from a slough due to gall-stone pressure; or in the case of cancer, surgical treatment should be directed in each case upon its own merits. In these the surgeon is called upon to display his genius, and his ultimate result will necessarily depend upon his ability to reconstruct or rectify as far as possible the damage done under the existing circumstances.

There are two elements to be considered in treating cholecystitis; first, there is an infection; and second, there will

develop sooner or later a mechanical blocking of the biliary passages. The infection is practically always blood borne, and the adjacent lymph involvement is secondary. While the direct route by surface seems occasionally to occur there can be do doubt as to the preponderating evidence in favor of the blood route as the common one. Certain mechanical conditions undoubtedly enhance the tendency to this infection, chief among which is stagnation or partial emptying of the gall-bladder. Where once this viscus becomes infected it is reasonably certain that it will remain so for a very long time or most probably for the entire future life of the individual. Neither chemic measures nor drain will succeed in overcoming it. Carefully selected diet, mild cholagogues and biliary antiseptics may cause the process to remain somewhat inactive and symptomless for a time, but do not cure.

In the course of time stone formation or inflammatory hyperplasia will give evidence of the existence of the disease by pain and obstruction to the flow of bile. During the period of mild uncertain symptoms or quiescence, damage is being accomplished by the infection nevertheless, and a pancreatitis, cardiovascular disease, arthritis, or other evidence of a toxic process becomes manifest.

Eventually, decided local symptoms begin to give distress of such intensity that the patients seek the surgeon or are sent to him by the internist. It is in this period that most surgeons first see the patient. At this time damage of a local, remote, or general character may have already been done which is irremediable and even though the surgeon may give the greatest possible relief under the circumstances, the patient can never be fully cured. Unfortunately this is sometimes held as discrediting surgery.

If this could complete the history it still might not be discouraging, but such is too often not the case. How many a patient will still bear his malady, resorting to olive oil, salhepatica, fruitola and occasional opiates, plus the advice of

family doctors and many friends, until a severe climax in complete block, gangrenation, or cancer necessitates a hazardous surgical operation when cure is impossible. Such we may say are the reflections of cholecystitis as mirrored by the past experiences of us all.

In discussing operative measures of relief I shall not tire you with elaborate details. I have found no peculiar advantage in the various incisions, one over another. Whether it be oblique, sigmoid, or rectus splitting, make it large enough for easy exposure and every need is met. As a routine I have not found it of advantage or easier to always begin to remove the gall-bladder at the cystic duct. In some it seems simpler, while in others it is easier and safer to begin separating the fundus from the liver and proceeding toward the duct. If all cases came early I should agree that the beginning dissection be made at the duct; but in late cases with marked inflammatory adhesions and thickening, danger is too often encountered by beginning at the duct. The anatomy of the gall-bladder and duct is also variable. The cystic duct may be three to four inches long or again less than an inch. In a few very late cases I have seen the common, hepatic and cystic duct dilated into one irregular channel filled with stones. In a condition of the kind the greatest care can only be exercised by commencing the dissection at the fundus of the gall-bladder.

The question of a routine exploration of the common and hepatic duct is one of the utmost importance. The existence of an unblocked passage for the flow of bile is crucial. This can only be assured by the passage of a sound or like instrument through the lumen of the duct if there is evidence of stone formation. In early cases, there being no stones in the gall-bladder, and a small undilated cystic duct, I question if it is necessary. I sometimes think that the trauma caused by passing does harm that cannot be counterbalanced by this assurance that the duct is open. But, in the presence of gall-bladder stone, it becomes imperative that full assurance

be had that the duct is open by, at least, instrumentally traversing the length of the common duct to the duodenum.

In some late cases where a persistent block of the common duct caused by stone, has existed for a long time, and the duct is dilated, it is quite possible to pass the finger through the entire length of the common duct. In the very rare case is it possible to pass the finger upward through the hepatic duct. In one patient, operated about sixteen months ago, I was able to explore both ways with the finger after removing a large medicine glass full of stones. In the duct extending into the left lobe of the liver I was able to detect the edge of a stone which by every method I failed to dislodge. Accordingly, I dilated the opening into the duodenum until my index finger passed readily through it. The man was put abed in a good Fowler position and I hoped the stone might pass. This last September I received word from his physician that he had had a severe hepatic colic of a day's duration. In another case in which I had removed several stones from a dilated common duct and passed a curved pair of stone forceps through into the duodenum, I operated again in about a year because of a recurrence of symptoms. I found the duct still somewhat dilated and filled with a mass of cholesterin of putty consistency. After removing this I found the duodenal opening again rather tight. I once more dilated it fully by passing the curved forceps into the duodenum, opening them to the capacity allowed by the duct. The patient has since been entirely free of symptoms. I have on several occasions had severe symptoms, somewhat like shock, follow within twenty-four hours after a common duct exploration. Only lately, on removing a gall-bladder full of stones, I passed the lead probe through into the duodenum assuring myself there were no stones present in the duct. While the probe rested in the duct I palpated along it to see that no stones had been passed undetected. The patient progressed nicely following the operation until suddenly, fourteen hours after the operation, marked shock became

evident with a pulse scarcely countable at the wrist. This lasted some hours and passed away fully. There was at no time peritoneal symptoms nor blood in the stools. I used the usual drain (a rubber tube to the stump of the cystic duct) and there was never any discharge through this. The patient was remarkably free from pain during the entire course following the operation.

Concerning drain of the wound, I am not as yet willing to close any but first stage cases. I do not believe a well placed drain causes damage, and I rest in much greater security after using one. A small rubber tube drain to the stump of the cystic duct is scarcely ever amiss and where I have a possible peritoneal contamination this is supplemented by a gauze gutta percha wick placed under this to the opening into the lesser peritoneal cavity.

A drain of the common duct is rarely necessary. In the few cases where I have thought it wise to use one, nothing has served so well as a rubber catheter with its end extending downward toward the duodenum and not upward toward the liver. The bile will flow backward through the tube as readily as though it had been passed upward into the hepatic duct. A "T" tube is not useful, as it may damage the duct on removing.

These few technical procedures cover the necessities of the usual cases operated. Where a dense cicatricial block has occurred in the pancreatic portion of the duct, or a cancer has invaded the passages, ingenuity of a highly developed kind only can meet the needs of such a situation. It would take me too far afield to discuss these matters in a paper of this kind.

In conclusion let me say that the chief plea I wish to make is for early operation; one which is not only made easier and safer for the patient by reason of there being no complicating factors, but one which will often save from many distressing ailments, local and remote, which cannot be fully relieved if the disease is allowed to run on in the blind hope that medical treatment can bring about a cure.

CAVERNOUS HEMANGIOMA OF THE LEFT LOBE OF THE LIVER, WEIGHING THREE POUNDS FOURTEEN OUNCES: TOTAL EXTIRPATION OF LEFT LOBE OF LIVER: RECOVERY.

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Cavernous hemangioma of the liver is a relatively rare condition, though a review of the literature shows a number of examples, both autopsy and operative reports.

The following case recently operated upon at the Roosevelt Hospital seems of sufficient interest to be worthy of record: Mrs. G. W., thirty-four years of age, born in Russia, married and has one child. Came to this country at the age of twenty-one. No previous history of any moment. For about one year prior to operation had not felt well, had vague discomfort in abdomen with occasional pain, and noticed gradual enlargement of abdomen; was troubled with gas and indigestion; bowels became constipated; lost about 22 pounds in weight. Symptoms more marked for the past three or four months. Physical examination, first made by her physician, Dr. J. W. Weinstein, four months ago, showed a large, soft, movable tumor in the epigastrium, extending from the ensiform cartilage to the umbilicus; smooth-surfaced, elastic, insensitive. Blood-pressure, urine and gastric contents were all practically normal. *X*-ray showed the stomach displaced markedly to the left, in a vertical position, its lesser curvature lying against the left border of the tumor. The mass was diagnosed as pancreatic cyst. It

enlarged slowly while under the observation of her physician, but did not change in position or consistence. When referred for operation on October 20, 1920, the examination was practically as noted, and the diagnosis of the pancreatic cyst was accepted, though there seemed to be rather unusual lateral mobility for such a cyst.

Operation was performed on October 22, 1920. The mass presented was of deep purplish color, smooth-surfaced, soft and elastic, free from adhesions. Above, it had a flat, broad pedicle, which, on examination, proved to be the stretched out coronary ligaments of the left lobe of the liver. Below, across its rounded margin, ran a remnant of the sharp edge of the left lobe. The right lobe of liver, gall-bladder and ducts were quite normal. Examination of the other abdominal organs, pancreas, spleen, kidneys, stomach and intestinal tract and pelvic organs was negative. Its attachment with the right lobe had been thinned, as had its whole pedicle, undoubtedly by the drag caused by its weight. It was at once evident that it was a lesion of the liver itself and not of the pancreas. It was thought to be probably some form of cyst and total excision was decided upon and performed without great difficulty. The vessels in the pedicle were secured by clamp and ligature, as it was divided step by step, and the mass was removed. The cut edges of the coronary ligaments on the under surface of the diaphragm were sutured with continuous catgut covering the wound surface between, and completing hemostasis. The tumor weighed 3 pounds 14 ounces (1759) grams) and included the entire left lobe. It was not sectioned at once, as we wished to obtain measurements, weight and photographs. A day or two later when cut it proved to be a solid mass and not a cyst. Microscopic sections showed this to be a typical cavernous hemangioma with much destruction of liver tissue and its replacement by the branching blood spaces and fibrous tissue.

The patient made a good recovery and the wound healed kindly by primary union. Convalescence was interrupted

by symptoms of a pulmonary infarct on the November 12, 1920. There was sharp pain in the left thorax, cough, blood-tinged expectoration and a rise of temperature. These symptoms continued three or four days, abating slowly, when another similar attack occurred. This was repeated, in all, three times. *X*-ray of the chest failed to visualize any infarct or area of consolidation. There was also noted, about November 9, 1920, a slight phlebitis of the right leg and calf. This was quite mild in type and subsided in a few days' time. The patient was discharged from the hospital on the thirty-second day after operation and is now quite well.

Pathological Report.—Specimen.—Entire left lobe of liver.—*Microscopic Examination.*—Specimen consists of a large rounded cystic feeling mass, of color of liver tissue, measuring 26 x 20 x 9 cm. and weighing 3 pounds 14 ounces. It is covered by peritoneum which is smooth and glistening, with the exception of one portion—oval in shape—measuring about 14 x 7 cm., where mass was dissected from diaphragm. Quite numerous, moderate-sized veins can be seen running under the capsule. The entire mass is soft and apparently contains fluid. At one border is a small tag of normal appearing liver tissue, which is firm, and on section has structure of liver. After hardening for several days, the mass is sectioned. Cut section shows a red, homogeneous surface, apparently very hemorrhagic, in which white, irregular islands and strands of tissue can be seen in large number. These are firm, while rest of tissue is soft and very bloody. After several more days in formalin, much of semi-fluid content of mass is drained out and the cut surface has a definite spongy appearance, from which fluid can be squeezed and which will again take up fluid. *Microscopic Examination.* Section I. Shows portion of large fibrous bundle to be made up of fibrous connective tissue. From this, septa pass out in various directions. Between these septa are masses of red blood cells. The septa are composed of connective tissue and surfaces are lined with a layer of flat-

tened cells, resembling endothelium. The section of liver-tissue looks normal.

Diagnosis. Cavernous Hemangioma of Left Lobe of Liver. This report was made by Dr. Wm. C. White, Surgical Pathologist to the Roosevelt Hospital, and confirmed by the Department of Surgical Pathology at the College of Physicians and Surgeons, Columbia University.

McCallum[1] cites briefly a large pedunculated angioma, 24 cm. in diameter, hung by a stalk from the right lobe of the liver, weight not given. Major and Black[2] report the largest tumor on record, 18,160 grams (37 pounds), 49 per cent. of the total body weight, at the time of death.

The tendency of these tumors seems to be to attain large size before proving fatal. Mantle[3] performed exploratory laparotomy for a huge hemangioma of the right lobe, 12 inches by 6½ inches in diameter; the patient dying within two hours from hemorrhage following needle puncture of the tumor and subsequent ineffectual attempts to control the bleeding by sutures and packing.

Chiara[4] reports a case operated on by Freund of rupture of an enormous angioma of the left lobe during exploratory laparotomy with death from hemorrhage within an hour. We have been able to collect records of 21 operative cases, in 17 of which the tumor was excised with 15 recoveries and 2 deaths. Of the whole number, 15 were females and 6 males. The left lobe was most frequently affected, the tumor being situated in the left lobe in 11 cases, the right lobe in 7, Spigelian 1, multiple tumors 1, site not stated 1. The largest case excised was that of Pfannenstiel,[5] reported also by Langer,[5] in which the collapsed growth weighed 5 pounds and the estimated weight, before the blood escaped, was 10 pounds. The patient made a good recovery ultimately, though the operative hemorrhage was great.

Keen[6] reports an interesting case, in which he formed an artificial pedicle by incising the liver on either side of the growth, then applying an elastic legature and packing the

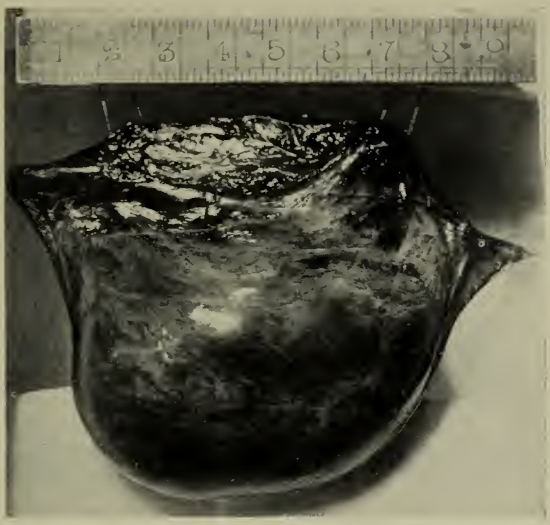

Fig. 1.—Photograph showing anterior surface of tumor, remnant of sharp edge of left lobe, and denuded area which lay between folds of coronary ligament at upper margin.

Fig. 2.—Photograph of tumor cut and laid open.

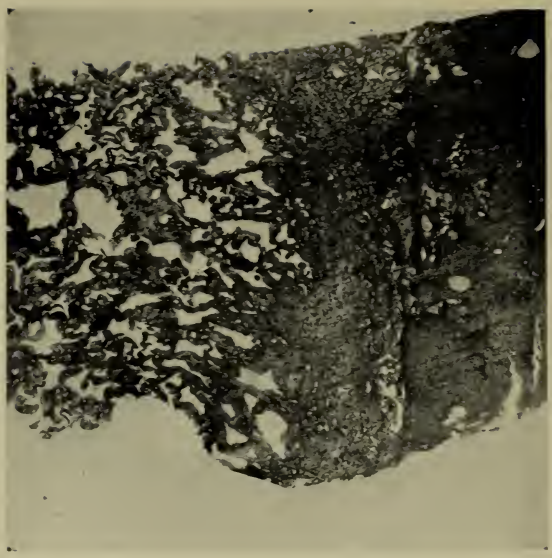

Fig. 3.—Photomicrograph, low power, showing tissue of hemangioma to the left, and liver tissue comparatively unchanged to the right.

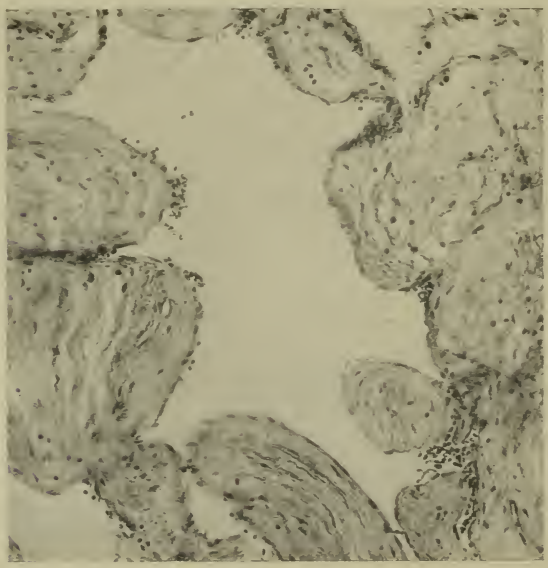

Fig. 4.—Photomicrograph, high power, showing structure of fibrous septa and endothelial lining of large cavernous spaces.

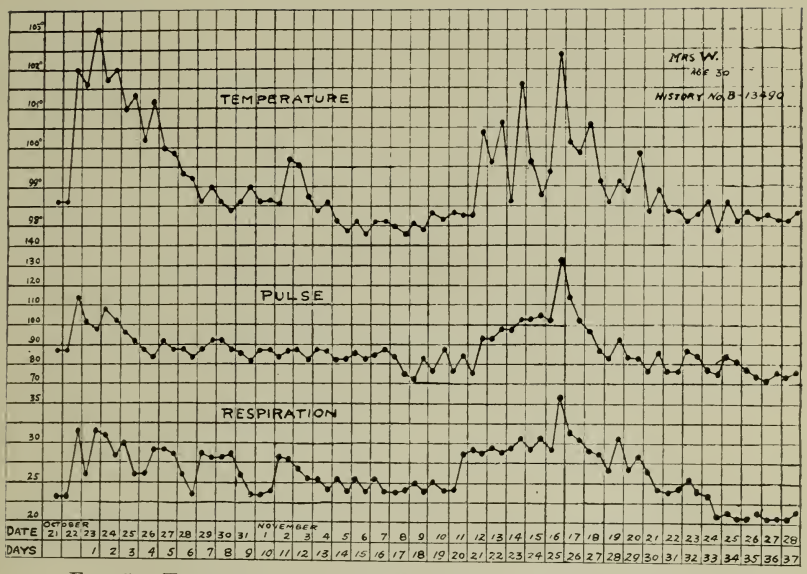

FIG. 5.—Temperature chart. Moderate operative reaction. Recrudescence of fever corresponding to pulmonary infarcts during convalescence.

Fig. 6.—Photograph of patient taken November 28, 1920, thirty-seven days after operation. A mass weighing 3 pounds, 14 ounces, and including the entire left lobe of the liver, was removed.

wound open. The means of controlling hemorrhage, reported by various operators, have been the elastic ligature, chain ligatures through pedicles, and use of the cautery and packing. In some of the cases, as in my own, the tendency to pedunculation of the tumor facilitated its removal, without great loss of blood. This tendency is evidently due to the weight of the tumor exerting a constant drag on the soft liver tissue and weak ligaments. On the other hand, excision of cases with broad attachments to the liver has been difficult and accompanied by serious hemorrhage. Incision into, or even needle puncture of the tumor, has proved exceedingly dangerous and even fatal in some of the reported cases. I believe our own case to be the largest tumor successfully excised in this country, and the second largest successful excision reported, the largest being the case of Pfannenstiel. No attempt has been made to review completely reports of non-operative cases.

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DISCUSSION ON THE PAPERS OF DRS. WITHERSPOON AND PECK

Dr. Henry O. Marcy, Boston, Massachusetts.—There are some compensations in being old, and I have one of them to report. Most of you know something of my work on the gall-bladder, gall-stones, etc., and you will pardon me for giving a little history. Bobbs, in 1847, did the first operation in America on a case of cystic form of gall-bladder. The gall-bladder was so large that he palpated it easily down to the median line. He thought he had an ovarian cystoma to deal with. He operated and the woman recovered. Who was Bobbs? Probably many of you do not know. I looked the matter up carefully and found he was a surgeon with a great deal of ability. He was a teacher of surgery and a surgeon in the Mexican War.

When I was in Germany in 1870 this question of gall-stone trouble was coming to the front and there was an earnest discussion with reference to pathological conditions of the gall-bladder. In 1881 I attended a meeting of the International Medical Congress, which was held in London, England, and there I met for the first time Mr. Tait. We were very good friends and I discussed several surgical questions with him. He told me about his history. He was to operate on cases of gall-stones and invited me to see him operate. Unfortunately I could not accept the invitation. I reminded him of the first operation done in America and he wanted to know what I was doing.

In the first case of gall-stone trouble I had, after studying it carefully from every standpoint, I made a diagnosis. Without going into detail I will say that I operated and recovery followed rapidly.

I will mention one case that occurred in the early eighties, in which I removed one large gall-stone from the common duct. There was also a large stone in the gall-bladder. The woman was decidedly jaundiced. On exploration I found a stone which weighed 57 grains, thoroughly impacted in the common duct, removed the stone, and sutured the gall-bladder and duct without drainage and closed the abdominal cavity. I put in three lines of continuous sutures and half an hour after the operation the woman vomited a great deal of bile. I saw this woman only a few days ago, almost forty years since the operation was done, and she is well.

Sometimes there is difficulty in making the diagnosis. In one case I thought I had to deal with a cyst of the pancreas. I found there was a cyst nearly as large as a double fist that contained over a thousand gall-stones and a pint of fluid. Operation in this case was followed by recovery. Those early cases form a part of one of the most interesting chapters in the surgery of today.

Dr. Thomas S. Cullen, Baltimore, Maryland.—A former president of this Association, the late Dr. Louis McLane Tiffany was one of the first to resort to excision of a portion of the liver. This operation was performed in 1890. Fifteen years ago I saw a patient with a large cancer of the left kidney. Seventeen months later she suddenly noticed a tumor of the liver which extended well down beneath the costal margin. It proved to be cancer of the liver. The nodule was 16 cm. in diameter. The tumor had a broad base. It was removed and all bleeding checked by the use of blunt needles. This case was reported in detail in the *Journal of the American Medical Association,* April 22, 1905. About a year and a half later there was a return of the growth in the left renal region where the original tumor had started. She finally died and my brother, Dr. Ernest Cullen, journeyed to her home several hours distant to make the autopsy. In addition to the local growth in the lumbar region he found three or four small secondary nodules in the liver. These showed no breaking down and were of recent origin. It is clearly evident that the large liver tumor that

we removed was the only one in the liver at that time, and had it not been for the local return at the site of the original kidney tumor with its subsequent hepatic metastases the patient would have had no further liver growths. The use of blunt needles is the key to the successful removal of accessible liver growths.

Dr. Charles H. Mayo, Rochester, Minnesota.—In a discussion of my first paper on gall-stones and diseases of the gall-bladder, many years ago, I made the statement that I was quite content to operate simply for the removal of gall-stones. The discussion of why gall-stones were present was about as fanciful as a discussion of some biblical statements. There was no real gain, and I was glad to have the subject brought up that cholecystitis exists first in the cases of gall-stones. They are secondary; they are produced by bacteria and these bacteria have a definite action in producing crystalloids and the material that makes up gall-stones, not necessarily from the bile itself but notably from the blood where all materials exist. I have seen gall-stones produced in these larger crypts of the gland by Rosenow with bacteria, from human gall-bladders with acute inflammation, injected intravenously into dogs. We now know something about the action of bacteria in these cases.

Dr. James E. Thompson, Galveston, Texas.—When I saw the title of this paper on the program I was tremendously interested in the subject, because in September, 1899, I published a case in the *Annals of Surgery* of removal of a tumor of the liver which I thought at the time was an adenoma but which proved to be a gumma.

I was not acquainted with the locked ligature which had been previously devised by Koushetzoff. I transfixed the pedicle with ordinary hatpins and tied a rubber band on the proximal site of the tumor and treated the stump extraperitoneally. It is astonishing how one can crush the liver tissue and how well the ligature will hold together all the important vessels without tearing them. On reading the title of this paper I was astounded at the amount of liver tissue which Dr. Peck had removed, and I could not help wondering whether the whole left lobe of a normal liver could be removed by such a method.

Another point of view struck me. In my Presidential Address before the Southern Surgical Association last year I described some anomalies of the gastric and mesenteric arteries. I found

one anomaly very common, in that the left lobe of the liver is frequently supplied entirely by arterial branches arising from the left coronary artery. In these cases there is no left hepatic artery arising from the main trunk. I have wondered whether in contemplating the removal of the left lobe of the liver if it would be possible to tie the left hepatic artery as a preliminary and so obtain a more or less bloodless operation. After this one might liberate the lobe by separating the coronary ligaments and delivering it in a systematic manner.

Dr. J. C. A. Gerster, New York City.—In reviewing the literature Dr. Peck spoke of one or two cases in which such free oozing followed puncture with the aspirating needle that the hemorrhage caused thereby proved fatal. About two weeks ago Dr. H. Neuhof read a paper before the New York Academy of Medicine upon the control of hemorrhage by increasing the coagulability of the blood. It occurred to the speaker that Dr. Neuhof's method would be applicable to control of oozing of the sort just mentioned. The injection of a 30 per cent. sodium citrate solution (6 to 8 grams for an adult of normal size, given over a period of twelve to fifteen minutes intermittently, *i. e.*, a few cubic centimeters every two or three minutes) resulted in a material shortening of the coagulation time (to two minutes); this change in the blood became apparent within ten to thirteen minutes after injection. The effect remained present in the blood for about twenty-four hours—sometimes a little shorter and at others a little longer. The method was given a clinical trial in 75 cases. There were no postoperative hematomas even in those cases in which it is common for them to occur; for example, after extensive dissections in breast amputations and postoperative ventral hernias. In an extirpation of the larynx there was no oozing at operation and only four small vessels had to be tied. Laboratory experiments reported upon by Dr. George Baehr, following Dr. Neuhof at the same meeting, seemed to indicate that injection of sodium citrate caused a prompt and very large increase in the prothrombin elements of the blood. In short, this procedure has been checked up by laboratory as well as by clinical experience, and seems to the speaker to be a very valuable addition to our means of controlling oozing both at operation and in postoperative conditions.

RELAXATION OF THE VAGINAL OUTLET: IS THE OBSTETRICIAN RESPONSIBLE?

By Lucius E. Burch, M.D.
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The normal vagina is a closed canal, the anterior and posterior walls being in contact. A relaxed condition of the vaginal outlet is rarely seen in women who have not born children; therefore, we must look upon childbirth as the etiological factor. I have been a witness in two hard fought lawsuits, in which the attending physicians were accused of negligence for permitting this relaxation to occur, and I am glad to report that the juries, after a careful hearing, decided in both cases in favor of the obstetricians. It is not unusual to hear a woman remark, that if she had received proper attention at childbirth a secondary operation would have been unnecessary. There is also a general impression in professional circles that a relaxed vaginal outlet can be prevented by properly suturing the perineum after labor. Hirst[1] says "that students are so well trained now that the hope is justified that a secondary operation of the perineum will soon be as rare as the need for operations for vesico-vaginal fistula." I have operated on a number of women with relaxed vaginal outlets, who had been attended by the best obstetricians in the country and whose lacerations had been sutured immediately following labor. The confused and erroneous impression of this condition, which exists, not only with the laity but also with the profession, needs to be cleared up. It is unnecessary to go into minute details of the anatomy of the perineum before this learned body.

According to Cunningham[2] the vagina is a closed canal, the two walls being in contact, the rectum being in close proximity at the upper part of the vagina. As the rectum approaches the outlet it is separated by the perineal body. All anatomists agree that the closed condition of the vagina is due to the action of the levator ani muscle through its pubo-rectalis portion. While this muscle keeps the walls of the vagina in contact, it is not a sphincter of the vagina. Peter Thompson[3] claims that the sphincteric action is produced by the levator ani and the bulbo-cavernosus. Paramore[4] says "the existence of the columns of the vagina depends upon the continued activity of the pubo-rectalis. The existence of the perineal curvature of the gut and the sigmoid course of the vagina are similarly dependent on the continued activity of the same muscle." This muscle is equal in width to the sterno-mastoid, twice as thick as the diaphragm, weighing one-fourth as much as the external oblique.[5]

The dynamic energy of the pubo-rectalis as developed by Dickinson[6] ranges from ten to twenty-seven traction pounds. It is found one-fourth of an inch inside the hymen and is attached to the vagina by strong connective tissue. It passes down behind the rectum uniting with its fellow of the opposite side. Contrary to the views of the old anatomists, no fibers are sent to the midpoint of the perineum. The muscle acts as a sling and holds the rectum and vagina upward towards the pubis, closing the vaginal orifice. Dickinson[6] states that "contraction of this muscle is capable of so firmly closing the lower end of the vagina that coitus and vaginal examinations become impossible. In exaggerated cases spasm beginning during the orgasm has held the male organ so firmly as to prevent its withdrawal for some time, in some cases until chloroform has relaxed it." Until recently gynecologists and obstetricians were united in the opinion that the muscle was ruptured during labor and many ingenious operations were devised for bringing together

the divided ends. Recently a few of the gynecologists have taken an opposite view.

Studdiford[7] in an excellent article shows that there is a band of involuntary muscular fibers that stretches across the perineal body from the pubo-rectalis on one side to its fellow opposite. He states that the pubo-rectalis is not injured during labor, but that a rupture occurs of the involuntary muscular fibers and that relaxation of the vaginal outlet is caused by the injury of these fibers, preventing the levator ani from firmly contracting.

Graves[8] in his last edition coincides with the views of Studdiford.[7] I agree with Studdiford that the involuntary muscles do exist, but I do not believe that the rupture of these fibers alone will cause an open vagina. My own view is that a relaxation of the vaginal outlet is caused by a lack of tone of the levator ani muscle, due to the overstretching which occurs at the time of labor. The cases of relaxation of the vaginal outlet found in women who have not born children are due to a poor muscular development, which is not only seen in the perineum, but is also associated with loose, lax abdominal walls. In my opinion the involuntary muscular fibers that Studdiford[7] has mentioned are for the purpose of holding back the rectum in its normal position as it turns backward to form the anus. When these fibers are injured the rectum bulges into the vagina causing a rectocele. This theory easily explains why in certain cases a cystocele is present without a rectocele. If the levator ani maintains its normal function and a complete tear occurs without involvement of the involuntary muscular fibers, neither a rectocele nor cystocele will occur. On the other hand, if the levator loses its normal tone and the involuntary muscular fibers are not injured, a cystocele will occur, but not a rectocele. If the involuntary muscular fibers are injured and the levator has not regained its normal function, cystocele and rectocele will both be present. I have never seen a case at operation, even with the most extensive

cystocele and rectocele, in which the levator ani could not be demonstrated intact and without laceration. It is impossible in certain cases for an obstetrician, however skilled or experienced, to prevent relaxation of the vaginal outlet in those cases where the levator ani has been stretched to the extent that it will not regain its normal tone. Every laceration following labor should of course be repaired at once. This primary operation tends to prevent sepsis and in some cases a relaxed outlet, but not always. It is impossible for an obstetrician to determine at labor whether the levator ani will fully regain its function, and for this reason it is advisable for the patient to report for observation every few months for a period of two years.

There is no special operation to advise. It is essential that the rectum be pushed back in its normal position by blunt dissection after the vaginal flap is raised. The two portions of the pubo-rectalis are then brought together in the median line by interrupted sutures. This takes up the slack in the muscle, makes a closed canal of the vagina and is followed by excellent results. If a large cystocele is present, a special operation on the anterior wall of the vagina is necessary.

In conclusion I desire to emphasize the following:

1. Relaxation of the vaginal outlet is caused by overstretching of the levator ani muscle and a lack of tone following labor.

2. It is impossible for the obstetrician to determine at labor whether the muscle will regain its normal function or not.

3. All lacerations following labor should be immediately repaired for the purpose of preventing sepsis, remembering that it will not prevent relaxation if the levator is overstretched.

4. The condition is easily cured at secondary operation by bringing together the overstretched muscle in the median line by interrupted sutures.

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CLINICAL STUDY OF A SERIES OF CASES OF RETROFLEXIO UTERI

By John G. Clark, M.D.
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The larger the number of remedies suggested for a given disease, the more unlikely it is of cure, may be stated as a medical aphorism. A few years ago Barrett made an inventory of all the operations which had been invented for the correction of backward displacements of the uterus and found that a well known pickle manufacturer had been surpassed in his 57 varieties. Since that statement was made the number has continued to mount until it now reaches at least 75. Upon the face of this assertion, the incurability of these disabilities would appear to be stamped. Certainly this is not true, for a simple retroflexion is not encompassed with such anatomic difficulties as to render so many ingenious operations of no enduring value. The pertinent query is not as to incurability, but as to the correct interpretation of the symptomatology arising from these anatomic defects. The crux of the error lies, not in the failure of mechanical correction, for there are several very excellent operations which are most effective so far as a mere anatomic restoration is concerned; but it unquestionably is to be found in the vague and haphazard definition of subjective symptoms.

As one views the modern intensive search for focal points of malign toxic emanations, we may at least hope that the much sinned against retroverted womb may have a surcease from surgical misadventure. Today the tonsillectomist and

the odontologist are holding court. For several years we have tried to steer a wide course away from a simple uncomplicated retroversion in a neurotic or neurasthenic woman with a symptomatology only limited by infinity, for such cases are made worse by these operations, just as the same class are more or less seriously maltreated by nephropexies when the kidney is not directly disturbed in its function. The part affected must speak directly and not through reflex marconigrams from distant organs, or through the subjective vagaries of a fatigued or disordered nervous system.

During the last ten years more than 400 cases of retroflexio uteri have passed through the Gynecologic Clinic of the University Hospital. Of this number we have selected for concentrated study 117 cases of simple dislocations or those associated with parturient injuries, all of the remainder having had some coincident operations such as those caused by infectious processes, or arising from lesions in adjacent organs, etc. Handler, over twenty years ago, excited much controversy in Germany when he asserted that an uncomplicated retroflexion seldom if ever gave any manifest subjective symptoms, but the intervening years have largely stamped this statement as accurate. In other words, a simple uncomplicated retroflexion which has no direct pelvic symptomatology practically never is the cause of backache, headache, constipation, or any disturbance of nervous equilibrium. This has been my teaching in the Univeristy Hospital for several years, but never before has the truth been more indelibly stamped with accuracy than by the summary of our results as tabulated in this paper. The fact is most strikingly demonstrated that backache, headache, and constipation are seldom relieved by retroflexion operations; indeed, such cures are unique. Instead of mitigating these complaints it would appear that they are actually increased by an operation.

It is not our purpose to stress the operation suggested by our Fellow, Dr. R. C. Coffey, which we have adopted in our

Clinic, although we believe it holds first rank in excellency; for, as stated above, it is quite obvious that there are other operations which may serve as well. Notwithstanding our efforts to avoid unnecessary, and, therefore, usually harmful operations, it is evident, as we have scanned the returns from our questionnaires, that we have also occasionally fallen into the pitfall so artfully dug by the neurasthenic or neurotic individual. When confronted with a many-paged closely written letter in answer to a questionnaire, the realization is borne in upon us that the mythological hydrahead monster still has a surgical identity. Fortunately, the great aggregate of cases, however, has yielded very satisfactory results. In the clinical study of these cases one fact is definitely established, and that is, there is no set of pathognomonic symptoms of retroflexion, but there is a group of suggestive symptoms, which centers within a disturbed menstrual cycle, and those caused by an actual drag or tugging of a dislocated uterus, such as bearing down sensations or a feeling of more or less constant weight in the pelvis. In the presence of a retroflexed uterus, these may be considered as subjective manifestations, for, of our tabulated list of complaints, they are the ones most uniformly relieved.

Thus, in our 117 cases it will be noted that those suffering from dysmenorrhea, bearing down or dragging sensations, a feeling of a mass in the vagina, menorrhagia, vesical disturbances, pain in one or both sides of the pelvis and leukorrhea were more uniformly cured or greatly relieved; whereas backache, constipation, nervous disturbances, and asthenia, were very infrequently relieved. Of 69 women suffering with backache, 41 were no better; of 83 suffering with constipation of varying degrees from mild to obstinate, only 25 were better, 51 no better, and 7 actually worse. Of those with nervous manifestations there were 21, with 6 relieved and 1 worse. Twenty complained of headache of varying severity; of these 9 were not benefited. For further analysis, we leave our Tables to speak for the results. In one phrase, however,

we may say with positive assurance that direct pelvic symptomatic manifestations will usually be cured or markedly improved, whereas so-called reflex and other general or remote symptoms will seldom be relieved; and, if the latter is the sole indication for the operation, any operation is unworthy of a trial. If we take the long chance of such an operation in the hope of an occasional cure, we may not with impunity take it for granted that in case of failure the patient will be no worse, for although a large percentage may remain *in statu quo* after their convalescence, a very considerable number will actually be made worse. The so-called psychic effect of any operation, unless actual physical relief follows in its train, is not beneficent but actually pernicious in by far the larger number of women. As surgeons and gynecologists, therefore, it behooves us to confine the actual manifestations of direct disturbances of physiology to a given organ, or an associated group of organs, before suggesting surgical therapeutics. In order to ascertain whether those women suffering with an uncomplicated retroflexion reveal any particular variation from those with associated parturient injuries, we have set these aside in special tables (Tables B). In a study of these cases in comparison with Tables A the results show relatively little difference.

In the answers to our queries there will be found an apparent discrepancy in curative results between the summaries in our two tables. While we have recorded the answers to our questionnaire as actually received, we have found in a large percentage as a final summary in the accompanying personal letters or through personal interviews that the patient gave a very enthusiastic account of actual benefits. In any follow-up system it is exceedingly difficult so clearly to define a questionnaire as to bring out the salient points for clinical investigation. Not infrequently when a patient has returned a very unfavorable questionnaire we find upon a direct interview and an examination that the aspect of the case is changed from an unfavorable to a very favorable report, because the patient was really 90 per cent. well, and

yet had stressed a 10 per cent. disability so strongly in her letter as to cast a bad reflection upon all of her answers. In several series of letters sent out in the investigation of various ailments we have invariably found this to be the case. A personal interview is, therefore, always preferable; but in any of the larger clinics of this country such a procedure is quite impossible, except in the smaller number of cases in close touch with the hospital.

Operative Technic. With slight modifications we have followed the technic as originally suggested by Coffey. The principles underlying the operation as we see it in our cases are, first, that it efficiently shortens the round ligaments by reduplication upon the anterior face of the uterus; and second, does much more than this, in that the relaxed and sagging anterior peritoneal layer of the broad ligaments is utilized to cover over the round ligaments, thus preventing the attached ligaments from breaking away and further utilizing the broad ligaments as a most important sustaining agent for the uterus. Further, the operation is neatly completed, and leaves almost no cause for adhesions. The method is easily executed; it is safe; it is enduring in its results, and, as abundantly proved by our cases, it is certainly free from criticism in its after-effects either in the menstruating or parturient woman. In over 400 cases, of which this uncomplicated series is but a part, we have found the immediate and remote effects most satisfactory. For purposes of actual definition of the curative value of a symptomatic uncomplicated retroflexion, we have rigidly excluded with a very few exceptions every case in which there were associated lesions, demanding surgical intervention, because such an inclusion would have completely beclouded the issue. For every case of simple retroflexion operated upon, we have advised almost as many against treatment in whom this dislocation existed but was unattended by a direct pelvic symptomatology. Our experience amply justifies Handler's contention that an uncomplicated retroflexio uteri in a large proportion of cases is attended with no direct disturbance in either uterine or

ovarian physiology, and should, therefore, be left severely alone both by surgically inclined physicians and those armed with pessaries and tampons. Between the evils of surgery and topical applications or pessaries in such individuals, there can be little choice, but of the three, certainly the last two are infinitely more pernicious. It is better to subject the young unmarried woman to an ill-advised operation than to condemn her to the interminable evil effects of a course of tampons or of pessary treatments.

As our experience in the surgical cure of these cases of symptomatic retroflexion has grown, we have discovered one definite type which is not satisfactorily relieved by the Coffey method, and that occurs in women, in whom, in addition to the acute retroflexion, there is a descensus of the uterus. In such instances the utero-sacral ligaments are elongated and should also be shortened by the method which Bovée has described. This additional disability is usually found in women who have born children, and is, therefore, seldom encountered in nulliparous women. Occasionally in young women, when there is an unusually deep Douglas' cul-de-sac of congenital origin, intra-abdominal pressure has so exerted its downward impress as to cause a descensus. To test the utero-sacral ligaments, the cervix should be caught with a tenaculum after the patient is under an anesthetic and gentle traction exerted; if the cervix appears at or near the vaginal outlet, the utero-sacral ligaments are usually elongated and should also be plicated upon the posterior wall of the uterus just below the cervico-fundal junction. Since we have adopted this additional measure, these cases have yielded better final results. In a few of our tabulated cases, the Bovée method has been employed, but it is chiefly since we began the study of this series that we have been impressed with the necessity for this supplementary aid.

This coincident anatomical correction adds practically nothing to the dangers of the Coffey operation, and will take up these relaxed sustaining structures with every promise of still better results. It is not our purpose to enter into a dis-

cussion as to the merits of other operations. We have tried several with varying results but have chosen this one because of the logical deductions made by Coffey in his original article. No operation for retroflexion, which does not give an open sesame to the abdomen, appeals to one's surgical judgment, first, because there are few uncomplicated cases of retroflexion which require an operation. A median incision under modern technic carries little or no danger and permits a full survey of the pelvic and abdominal organs. Thus we attribute the relief of at least a few cases of right-sided pain to a coincident appendectomy; Secondly, in every complicated case, and as most cases of symptomatic retroflexio uteri are of this class, the associated lesions require a laparotomy if the patient is really to be cured.

No case operated upon within a year and a half is included in our study.

Conclusions as to Symptoms in Cases of Pathologic Retroflexion of the Uterus: 1. To justify the assumption that a retroflexed uterus requires treatment the symptoms must directly be referable to the pelvic area. The capital ones are disorders of menstruation, chiefly of the central painful type; dragging sensations, or a feeling of weight or of pressure often designated subjectively as a "falling sensation;" disturbed vesical function (irritable bladder and dysuria); leukorrhea; and pain in one or both ovarian regions.

2. Backache, headache, digestive disturbance, neurasthenia, or disturbed nervous equilibrium, even when associated with the above symptoms, will frequently be unrelieved by an operation and practically never, when they are not coincident with outstanding pelvic symptoms. To the contrary, they will usually be made worse. In such cases all treatment of a retroflexed uterus is positively contraindicated.

3. There is no etiologic relationship between constipation and a non-adherent retroflexion. Instead of being relieved, it may actually be made worse by an operation for retroflexion, when this is the sole or chief indication for the operation.

TABLE A. SUMMARY OF COMPLAINTS AND RESULTS OF OPERATIONS IN 117 CASES OF SIMPLE RETROFLEXIO UTERI AND THOSE ASSOCIATED WITH PARTURIENT INJURIES

	Cured or greatly improved.	No better.	Worse.	Total.
Constipation (moderate 63, obstinate 20)	25	51	7	83
Backache	28	41	0	69
Constant weight and dragging sensation	41	4	0	45
Dysmenorrhea	41	2	0	43
Leukorrhea	32	8	0	40
Acute or chronic pain in right side	26	2	0	28
Asthenia and general nervousness	6	21	1	28
Pain in both sides of abdomen	21	2	0	23
Sensation of mass in vagina	23	0	0	23
Frequency of urination	17	4	0	21
Headache	11	9	0	20
Menorrhagia	17	1	0	18
Dysuria	14	2	0	16
Frequent menstruation (irregular)	14	2	0	16
Indigestion, tympanites, acid and gaseous eructations, etc.	7	7	0	14
Pain in left side of lower abdomen	12	1	0	13
Dyspareunia	2	0	0	2
Pain in upper right abdomen	3	0	0	3
Loss in weight	2	0	0	2
Unable to control urine	3	0	0	3
Cases of Associated Gall-bladder Disease:				
Removal of Gall-bladder				1
Drainage of gall-bladder				2
Adhesions of the gall-bladder (no surgical intervention)				2
Nephrorrhaphy with Coffey Suspension				1
Cases of Simple Coffey Suspension with Routine Appendectomy				52
Cases of Coffey Suspension with Combined Operations:				
Suspension with anterior and posterior colporrhaphy				4
Suspension with anterior and posterior colporrhaphy and repair of cervix				7
Suspension with repair of cervix and posterior colporrhaphy				31
Suspension with posterior colporrhaphy				13
Suspension with posterior colporrhaphy and Hunner's cauterization of cervix				
Suspension with repair of complete tear				1
Suspension with repair of complete tear and cervix				2

Suspension with posterior colporrhaphy and hemorrhoidectomy	4
Suspension with repair of cervix	2
Ages of Patients:	
Under 20 years	6
From 20 to 25 years	21
From 25 to 30 years	31
From 30 to 40 years	47
From 40 years and over	12
	117
Summary of Results in Simple and Combined Operations:	
Cured or markedly improved	114
No charge	3
Worse	0
	117
Replies from Questionnaires:	
Do you suffer at your periods?	
No	79
Yes	34
Pelvic pains and cramp	16
Backache	17
Discomfort	3
Soreness and burning	1
Headache	12
Nervousness	4
Pain over ovaries	2
Menopause	7
Have your periods changed in any way since operation?	
1. Regularity:	
(*a*) Regular	106
(*b*) Irregular	11
2. Amount of flow:	
(*a*) Normal	97
(*b*) Profuse	8
(*c*) Scanty	12
3. Length of flow:	
(*a*) Normal	101
(*b*) Prolonged	5
(*c*) Diminished	11
Single women: Have you been married since operation?	
No	7
Yes	5
If so, pregnant now	2
Married women: Have you had any children or miscarriages since your operation? Any trouble with your labors?	

Para.	Miscarriages.	No change.
28 women, 1 child each	9 women, 1 miscarriage	71
7 women, 2 children each	1 woman, 2 miscarriages	

Labors:

Prolonged	3
Forceps	3
Breech presentation	3
Uneventful	26
Induced	1
Retained placenta	1
Shoulder presentation	1

Subsequent Operations Since Leaving University Hospital:

Goiter	1
Fissure in ano	1
Adhesions to uterus	1
Pelvic inflammatory disease	3
Dilatation and curettage	1
Cholecystectomy	1
Plastic following childbirth	6
Removal of cyst	1
	—
	15
No operations	102

Are you Troubled with the Following?

1. Leukorrhea:	
None	58
Slight	24
Moderate	32
Bad	3
2. Discomfort in urination:	
None	81
Slight	23
Moderate	12
Bad	1
3. Constipation:	
None	59
Slight	11
Moderate	40
Bad	7
Recurrence following childbirth	1
Recurrence, never pregnant but uterus is back	2

Complicated convalescence, negative.

Surgical deaths, 1 (pulmonary embolus) twelve days after operation.

Deaths after return home, 2 (tuberculosis); 1 case unknown, probably intestinal obstruction following cholecystitis.

TABLE B. SUMMARY OF COMPLAINTS AND RESULTS IN 52 CASES OF SIMPLE COFFEY SUSPENSION OPERATIONS

	Cured or greatly improved.	No better.	Worse.
Painful disorders of menstruation	20	1	0
Constant weight and dragging sensation	25	1	0
Frequency of urination or dysuria	14	4	0
Headache	5	10	0
Backache	10	15	0
Constipation	8	20	3
Sudden pain in right side (appendix)	7	0	0
Pain in left side	1	1	0
Leukorrhea	12	1	0
Abdominal distress and indigestion	3	1	0
Frequent menstruation (irregular)	7	1	0
Menorrhagia	4	0	0
Sterility (chief complaint)	2	0	0

Pregnancies Since Operation, 12	
Miscarriages	5
No change	31
Labors:	
Prolonged	2
Uneventful	8
Retained placenta	1
Subsequent Operation:	
D. and C. and hemorrhoidectomy	2
Plastic	2
Recurrence, 1 (reported by physician).	
Summary of Results of Operation in 52 Uncomplicated Cases of Retroflexion:	
Cured and greatly improved	50
No improvement	2
Do you suffer at your periods?	
No	40
Yes	12
Severe pains	5
Backache	4
Headache	2
Cramps	1
Regularity of flow:	
Regular	47
Irregular	5
Normal flow	45
Profuse	4
Scanty	3

Length of flow:	
Normal	44
Prolonged	2
Diminished	6

Are you Troubled with the Following?

	No.	Moderate.	Excessive.
Leukorrhea	32	20	0
Dysuria	39	13	0
Constipation	24	24	4

Ages of Patients:	
Under 20 years	2
From 20 to 25 years	22
From 25 to 30 years	14
From 30 to 40 years	12
Above 40 years	2

In no case should so-called reflex, or, as we prefer to designate them, pseudo-reflex symptoms, be the indication for an operation. Under the decree of an operation, such patients will almost invariably be disastrously affected, because these ill-defined manifestations do not emanate from such causes, and the patient, therefore, falls a victim to a narrow specialism or to an error in diagnosis by a superficial physician or surgeon.

Conclusions as to the Results of the Coffey Operation: 1. It gives a good restoration without distortion of normal anatomic relationships and without unfortunate sequelæ.

2. It is very effective as shown by the very small percentage of recurrence either before or after parturition.

3. In cases of an associated descensus uteri the operation should be supplemented by the intraperitoneal shortening of the utero-sacral ligaments, as suggested by Bovée.

Finally, there are other operations which without doubt permanently restore the retroflexed uterus to its normal position. When failure of relief of symptoms follows, if there are no post-operative sequelæ, the fallacy lies not so much in the details of the operation as in an incorrect interpretation of symptoms. To recur, therefore, to the prefatory statement in this paper, one may conclude that this opprobrium

falls not upon a well-devised operation *per se* but upon its misapplication. Therefore, to successfully deal with these misplacements, one must select those with a direct and positive symptomatology, for in most instances a simple retroflexion of the uterus is unattended with any disturbance in the physiology of the pelvic organs.

In the preparation of the statistical details of this paper, I am indebted to the indefatigable efforts of my assistant, Dr. Henry B. Mikelberg, for the painstaking care which he has shown in sifting out the data pertaining to the after-results.

UTERINE PROLAPSE: PERMANENT FIXATION BY FASCIAL FLAPS.

By W. Burton Thorning, M.D.
Houston, Texas

If there be any excuse for suggesting another method for the relief of uterine prolapse it lies in the fact that the very multiplicity of previous methods proves that no one of them has given universal satisfaction.

Every case of uterine prolapse constitutes a separate and distinct problem and should be viewed from every conceivable angle before attempting any operative procedure. If this is done and the operator is possessed of sound surgical judgment, he will be compelled to vary his technic to the extent of adopting what seems to be the best method for a given case. In other words, he will not adapt patients to operations but operations to patients.

It is not the purpose of this paper to enter into the etiology of uterine prolapse, any further than to refer briefly to the type of patients wherein it appears to the writer that this particular operation is indicated, nor will reference be made to repair of the damaged pelvic outlet which will be assumed, nor will any reference be made to the many most excellent methods which have been previously described and widely used, as your familiarity with them makes this unnecessary.

The method about to be described, with the aid of the illustrations, will be found to have a very limited field of usefulness and to those who believe the uterus should always be removed in every case of prolapse it will not appeal at all.

There are those, however, who can see no reason for removal of an otherwise perfectly normal uterus simply because through loss of its natural supports, it has become prolapsed. There are others will who argue that any superstructure should rest on a foundation at its base instead of being suspended from its summit and as pure theory this view is correct. From a practical standpoint, however, it will be found that this method will not suffice for all cases.

It may also be argued that a failure with any of the various popular methods is not the fault of the method, but the fault of the operator, in that he was guilty of faulty technic or of an error in judgment in applying that particular method to the case in question. This would undoubtedly be true in many instances but the fact remains that with all the knowledge, judgment and skill that we possess we are compelled to record a failure now and again with any and all methods.

It was one of these "failures" which had been operated upon some years before in another clinic that led me to attempt a permanent fixation to the anterior abdominal wall by means of a strip of the rectus sheath carried directly through the fundus. As before stated, this procedure will not prove adaptable to more than a small proportion of the cases of prolapse. It is now slightly more than five years since I did my first one and since that time I have had only seventeen more in which I felt certain it was to be preferred over all other methods. A total of eighteen cases is of little value to statistics in demonstrating the desirability of any surgical procedure and my only purpose in presenting it is to accord the profession the opportunity of determining for itself whether it be worthy or unworthy of trial at other hands. If the method is a useful one it should be more widely used; if not useful it should be rejected.

I believe there is a certain type of women where this fixation will prove more generally satisfactory than any method with which I am familiar. We all recognize the typical enteroptotic figure, with the slightly stooping shoulders, the flat chest,

the flabby breasts, the pot belly and the broad hips. They are usually constipated, suffer from headaches and other toxic symptoms and the prolapsed uterus may, to a certain extent, be part and parcel of the general visceroptosis. In all these cases we will find the entire muscular system soft and flabby, the uterine ligaments relaxed and attentuated and the entire pelvic diaphragm presents the appearance of having been torn loose from its attachments. In this class of women we will get no permanent support from the perineal body, no matter how carefully it may have been rebuilt; we can expect no permanent help from the anterior pubic or the utero-sacral ligaments; there is a giving way of the whole perineal segment, the pelvic diaphragm and pelvic organs are low in the vagina, intra-abdominal pressure is exerted in the wrong plane and recurrence, with anything short of fixation, is almost inevitable.

In common with all other fixations this method should not be employed if there is any question of malignancy or fibroids or in women in the child-bearing age, unless sterilized, or in badly infected uteri. Of the eighteen cases in our list all were past the menopause except one and she had previously been subjected to a bilateral salpingectomy. There has been no mortality and in fourteen cases the results have been exceedingly gratifying.

Of the eighteen cases reported in this paper, two have been operated more than five years, two more than four years, three more than three years, four more than two years, three more than one year, one has been lost sight of and three have been done since January, 1920, and are too recent to include in statistics.

Of the fourteen included in this study, all have been examined at least one year following operation and several have returned for examination three or more times. In every single instance, they have been entirely relieved of their symptoms. In one case, the third in this series, and in which a ventral suspension had been done ten years before, the

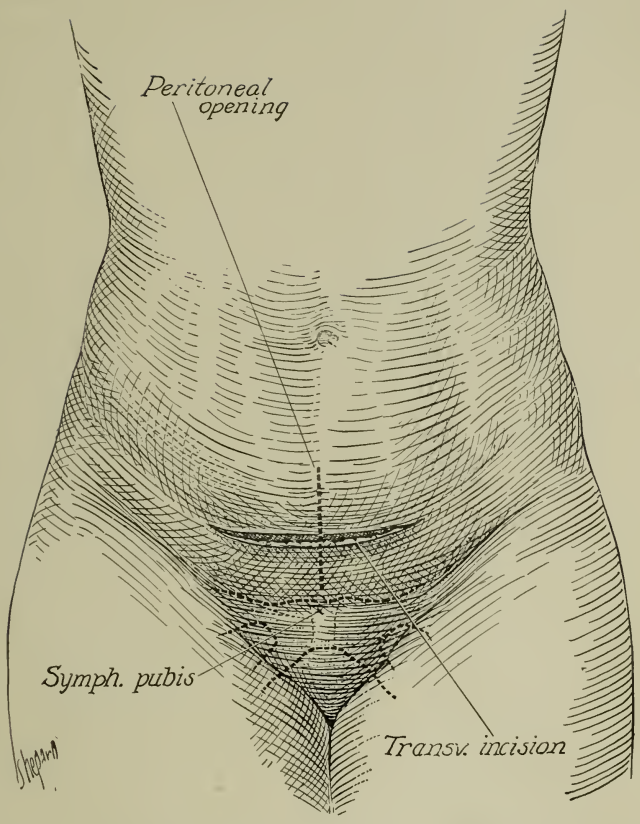

Fig. 1.—Transverse incision through skin, subcutaneous tissues and aponeurosis of the rectus muscles: dotted line, incision in peritoneum.

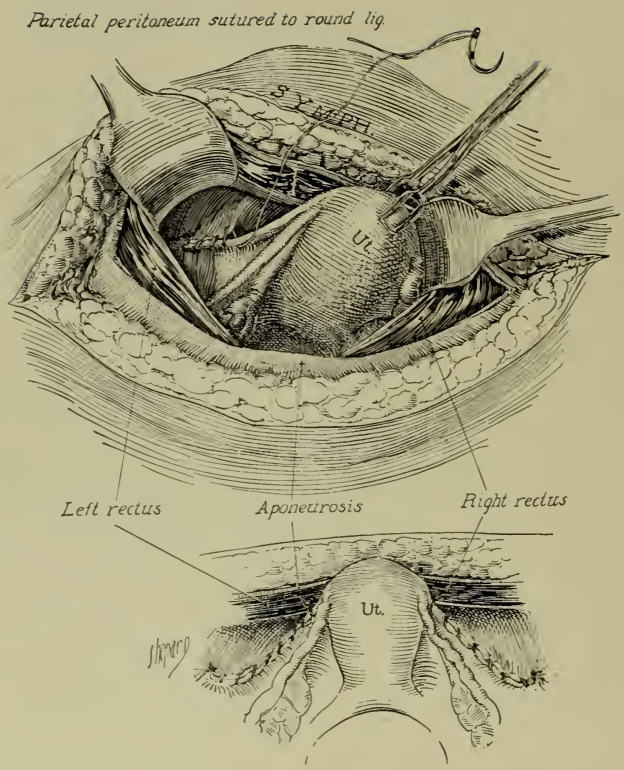

Fig. 2.—Running suture of plain gut, attaching round ligaments to parietal peritoneum; inset, suture completed.

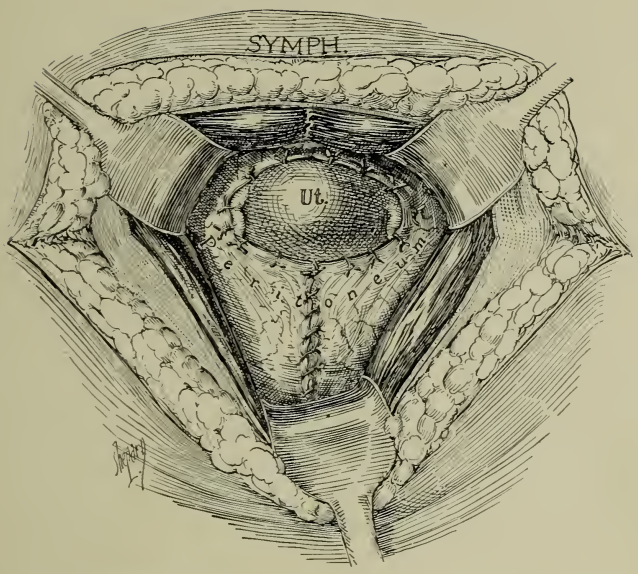

Fig. 3.—Peritoneum closed snugly around fundus with continuous or interrupted suture of plain gut.

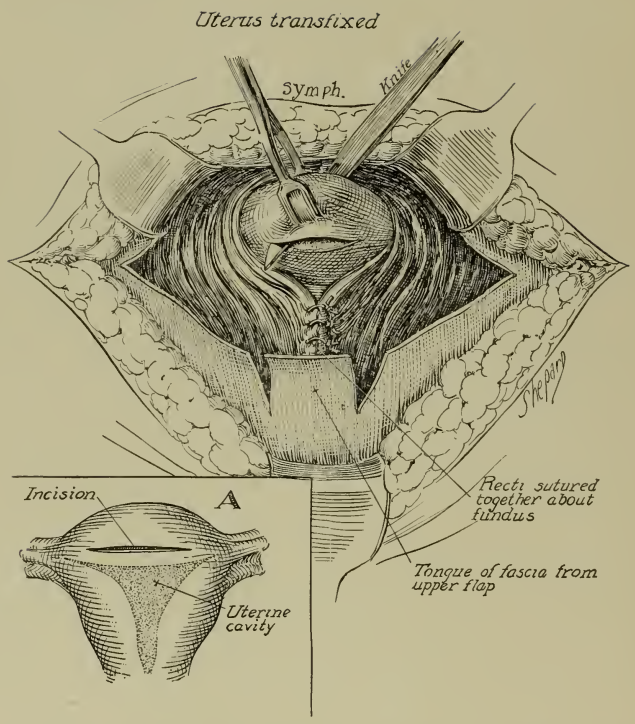

Fig. 4.—Rectus muscles brought together; incision through fundus; tongue of fascia split from upper flap; *A*, relation of incision to uterine cavity.

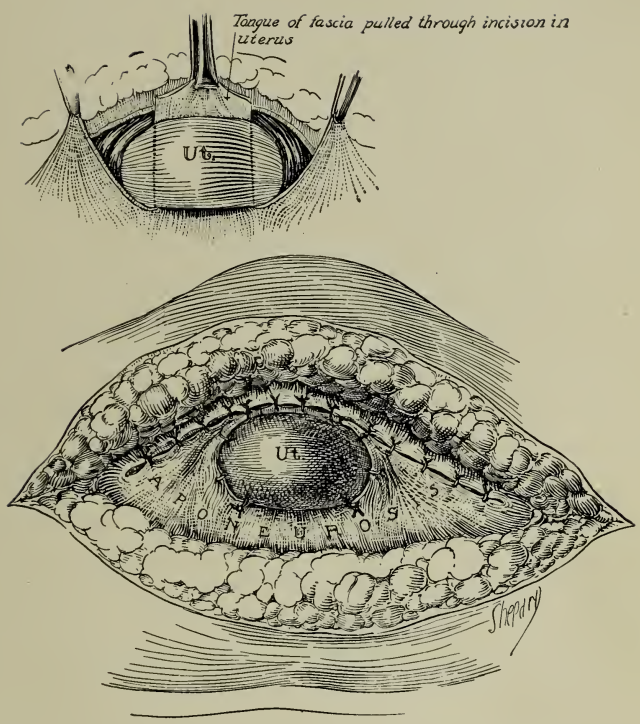

Fig. 5.—Divided fascia reunited with interrupted sutures of chromic gut; inset, tongue of fascia being drawn through incision in fundus.

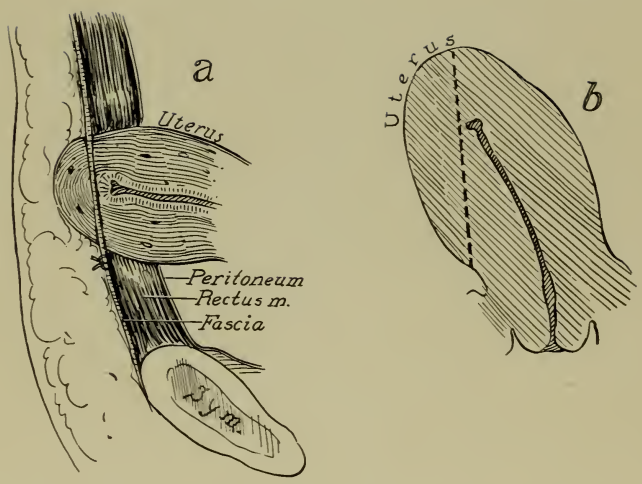

FIG. 6.—*a*, ordinary incision through fundus; *b*, incision where relaxation is extreme.

uterus was much elongated and still appeared to be carried somewhat low, but she was symptomatically well.

In one case only has there been any postoperative complication. It was our first case and as we did not allow for drainage we were somewhat humiliated by having a hematoma form under the skin flaps which delayed the convalescence by several days. This leads me to call attention to one step in the procedure which, theoretically, is a violation of a surgical principle, namely, the cross-section of the vessels running to the fundus. Practically it presents no difficulties if a small rubber tissue drain is carried down to the incision in the uterus and allowed to remain for from twenty-four to forty-eight hours.

Briefly the technic is as follows: An ordinary transverse incision, which for the most part is below the upper margin of the pubic hair line, is carried through the skin and subcutaneous tissues to the aponeurosis of the recti muscles. The upper flap is then separated from the fascia upward for a distance of three inches or more as necessary to provide working space. The transverse incision in the fascia of the recti muscles should be not less than one and one quarter inches nor more than two inches above the pubic symphysis. The recti muscles are then separated and the peritoneum opened in the usual way. Through this incision any necessary pelvic work may be done. The fundus is then grasped with a volsellum forceps and the rectus muscle retracted in the opposite direction, while a running suture of plain gut attaches the round ligament to the parietal peritoneum of the anterior abdominal wall on either side. This step in the procedure is not taken with the idea of securing additional support but for the purpose of shutting off the pelvic cavity below the point of fixation. The peritoneum is then closed with a running suture bringing it snugly around the fundus as shown in the illustration (Fig.1). The recti muscles are then brought together by interrupted sutures as nearly to the fundus as possible (Fig. 2).

Next a strip or tongue, from one to one and one-half inches wide, is split from the middle of the upper fascial flap. The fundus is then transfixed with a scalpel which carries the incision from one side to the other; the incision is placed as deeply as is possible and avoid entering the uterine cavity (Fig. 3). The strip of fascia is then carried through the incision in the fundus and sutured to the point on the lower fascial flap where it was originally divided (Fig. 4). The divided fascia is then reunited by interrupted chromic catgut sutures (Fig. 5). The skin is closed in the usual manner.

Some variation in placing the incision in the uterine wall will be necessary according to the degree of mobility present. When there is great relaxation, it can be carried down the anterior wall and emerge as low as the utero-vesical fold of peritoneum. In two cases we dissected the bladder loose from the anterior wall and brought the fascial flap out through the cervical portion, transplanting the bladder by tacking sutures to the anterior fold of the broad ligament. A little experience will enable one to estimate with considerable accuracy the location of the incision which will afford the necessary degree of support.

DISCUSSION ON THE PAPERS OF DRS. BURCH, CLARK AND THORNING

Dr. R. C. Coffey, Portland, Oregon.—Dr. Clark's papers are always practical and interesting. We send our radium to the Bureau of Standards, and I think I may call Dr. Clark the Bureau of Standards in surgery, and you do not know how anxious I have been to get his report in his cases in which I have known he has been gathering results for the last year.

Taking up the question of operation, one is reminded of the art galleries of Europe. There you will find very prominently displayed "A Picture of An Old Man," "A Picture of a Woman," "A Picture of a Girl." The respective pictures do not represent

any particular man, woman or girl, but are intended to be generic in character representing common characteristics. Many surgeons will take up and attach a man's name to some technical thing and not consider the principles upon which it is based. A surgeon will devise a technical operation and have no regard whatever for the principles involved. I have arrived at exactly the same conclusions that Dr. Clark has, namely, that each case may require slightly modified technic. If I were to describe a separate operation for the various technical modifications I have made in the hundreds of cases I have performed by this method it would probably read Coffey No. 1, 2, 3, etc., up to Coffey No. 50, sounding like Billroth No. 1 and 2 in stomach surgery. When we move the broad ligament for an inch forward or move it back an inch or in or out, we should not say it is a different operation, and call it by some special name. What we are after is the principle and not the name. My original paper dealt with the principles underlying this work and not so much with names, and we should endeavor to make use of those principles, which are correct. One thing I intended to bring out in the first place is that through some anatomical mistake gynecologists have considered the round ligament—such a ligament as you have in a joint. As a matter of fact the round ligament is a muscle whose purpose always is contraction. Therefore the round ligament has a definite action besides that of simply holding up the uterus, namely, poising the uterus on its supports. The point we have here is not whether we have attached the ligaments high or low, inward or forward. I have called attention to the fact that we do not strangulate the round ligament. It has been said by Holden, of New York, that in doing this operation the round ligament atrophies. In answer to this I may say that if in doing a herniotomy the cord is strangulated in three or four different places, or even in one place, he may expect atrophy of the testicle. We know exactly the kind of operation Holden did to produce atrophy of the round ligament. He surrounded and included it in his ligatures. There are two round ligaments or involuntary muscles which poise the uterus on the broad ligaments or peritoneal supports, including the pelvic fascia along with it, so that the point we have made particularly is to avoid transfixing the round ligament entirely while plicating the round and broad ligaments over the front and fundus of the uterus. It does not matter whether you do it in this manner or in that

manner, or bring the peritoneum slightly backward or forward, so that it meets the mechanics of the case in hand.

Here is a point I want to bring out: If the round ligament is not strangulated it is gradually straightened out. While the broad ligament furnishes the suspensory support the round ligament being relieved of its burden is increased in size and straightens itself out entirely underneath the peritoneum. The round ligament, which is muscle largely, we must not destroy or cripple if we are to expect a perfect result. We must depend upon the peritoneum and underlying pelvic fascia for most of our work as far as suspensory support is concerned.

Dr. F. G. Dubose, Selma, Alabama.—We know that many operations have been devised by various men for the correction of these pelvic deformities, and it is only by friendly criticism and a careful examination of the different procedures that we may some day be able to devise and crystallize one method that is worth while if the ultimate is ever obtained.

The only criticism with reference to operations for suspension of the uterus is that of plication operations; all fixation operations are violations of normal anatomy. Particularly is this true of plications of the round ligaments. As pointed out by Dr. Coffey it is a muscular structure.

Last year many of you will recall I reported one procedure of a great many that simplified effort on my part to support the round ligament until that muscular structure regained its tone. That operation was so satisfactory in my work that I had the temerity to ask Dr. Trout to throw it on the screen because there are one or two corrections I should like to make. (Dr. DuBose then described his method by means of lantern slides.)

Dr. Edward H. Richardson, Baltimore, Maryland.—Dr. Clark's exhaustive and accurate analysis of the results of his operations is an admirable example of the sort of statistics that are really worth while. One of the striking features of his report is the variety of symptoms which he found it necessary to record as having been encountered in connection with uterine displacements. This fact takes on added significance, too, when we recall the multiplicity of operative procedures which have been proposed by surgeons for the relief of these symptoms. That there is as yet no unanimity of opinion regarding the choice of opera-

tion best applicable to any of the specific types of uterine displacement is a tacit admission that there still remains in every clinic a vexatious percentage of failure to cure, no matter what operation is employed. The reason for this, it seems to me, is to be found not so much in faulty operative procedures as it is in a failure to comprehend that these patients present not one but at least three therapeutic problems. One of these is in the domain of the gynecologist and relates to the surgical correction of pelvic pathology. One is orthopedic in nature and involves an accurate knowledge particularly of the abnormalities of the lumbar spine, the lumbosacral and the sacro-iliac articulations, some of which are nearly always associated with those mechanical displacements of the reproductive organs which produce symptoms. And one is in the province of the internist, having to do with the multitude of functional and metabolic disturbances, often remote from the pelvis, which always sooner or later become an associated part of the clinical picture. Operative therapy alone, therefore, will not suffice and the gynecologist who takes due cognizance of this fact, as well as of his own limitations, and who freely associates with his own the therapeutic efforts of both the orthopedist and the internist in the management of these cases, will be rewarded by observing a gratifying percentage of improvement in his end-results.

Dr. Willard Bartlett, St. Louis, Missouri.—The gist of the whole matter, as Dr. Clark has presented it, seems to be this, I believe the more we can say in a few words the better it is understood, namely, that Dr. Clark has had the whole patient in mind and not the uterus alone.

Dr. Guy Le Roy Hunner, Baltimore, Maryland.—In taking a broader viewpoint, and at the risk of wearying you with the subject of ureteral stricture, I wish to put in a plea for taking a look at the patient from a urological standpoint. As you know many of these patients come in complaining of other things, such as dysuria, and if you will take their histories carefully you will find a good many of them do not have bladder symptoms constantly. They are intermittent. In other words, whatever it is that is causing the bladder symptoms is active only at times, and on further investigation you will find these are probably cases with slight urethritis or trigonitis or ureteritis, due to focal infections, and the irritation is operative only a

part of the time. Those cases that do have stricture often complain of the symptoms that are typical of the prolapsus cases. In fact, they come in telling you they have falling of the womb, and when you ask them why they think they have this malady, they tell you usually that some doctor has told them; but they emphasize the dragging in the broad ligament regions. Sometimes they tell you they have ovarian trouble and bilateral pain, and they have these intermittent bladder symptoms and are liable to have dyspareunia. Unless you take up these cases and treat them for their strictures first you will be disappointed in your operations. I am having patients come to me that I operated on six or eight years ago, and I remember how unsatisfactory the results of my perineal repairs and uterine suspensions were as regards the patient's symptoms. I kept track of them for a year or two afterward, using tampons and treating the trigone and urethra, and failing to give much relief, I then put them down as neurasthenics. Now when they come I go back over the old histories and usually they present an absolutely typical history of ureteral stricture, and they still have the symptoms they had before my operation. So I think it is all-important to keep this lesion in mind.

Dr. Francis Reder, St. Louis, Missouri.—With reference to painful conditions in the pelvis it can be said that frequently a pain attributed to the uterus can be ascribed to the ovaries. In a malposition of the uterus, a retroversion with or without a retroflexion, we invariably find a prolapsed condition of the ovary with its accompanying passive hyperemia. A passive hyperemia engenders irritation and irritation usually means pain. Whenever the correction of a malposition of the uterus is undertaken and the prolapsus of the ovary is neglected the patient will not be benefited as far as pain is concerned, be that pain in the side of the abdomen or in the back. It becomes absolutely necessary that the ovary be restored as near its normal position as is possible.

Dr. Charles L. Bonifield, Cincinnati, Ohio.—I did not hear all of Dr. Clark's paper but I did hear the discussion. I have heard no one mention what I regard as the main cause of symptoms in displacements of the uterus, that is dilatation of the veins in the broad ligament. If they are dilated one will have marked symptoms. If they are not much dilated the

symptoms will not be marked, and any operation that does not lift the uterus sufficiently high to relieve them of this dilatation or does not cure them in some other way will not cure the patient.

Dr. Clark (closing the discussion).—I have very little further to say except to lay stress upon the chief point which was studied in these cases of retroflexion operations. In other words the symptoms must be direct and not remote if we hope to secure a satisfactory cure of many cases. What Dr. Coffey has said relative to the permanency of his operation we fully substantiate. Recently one of his assistants was in our clinic when we operated upon a patient with an ugly inflammatory disease, upon whom we had performed a Coffey suspension operation several years previously. At this operation we found the round ligaments beautifully holding the uterus in good position. There had been an ideal fusion of the reflected peritoneum with the uterus and it had restored the uterus to a perfect position. We can say unqualifiedly, as does he, that this operation does not interfere with pregnancy. Dr. Hunner's suggestion relative to the probability of some of the unsatisfactory cases that the trouble lies in the bladder or ureters we also coincide with. As to the question of stricture of the ureter I am as yet very much in doubt and cannot participate with Dr. Hunner in his great enthusiasm over the result in these cases. We are not in accord with him as to the frequency of stricture, nor have we been able to secure the results which he reports. As to the question of solitary ulcer of the bladder which Dr. Hunner has described I look upon this as a very remarkable original contribution to surgical literature. We very fully approve his statements relative to the incurability of these small local ulcers except by operation. We have now had thirteen such cases, and in no surgical operation have we secured more satisfactory results than in these. I wish we could find as much satisfaction in treating the so-called strictures of the ureters as he does. Perhaps it may be due to the fact that we have not carried out his technic as carefully as he pursues it.

THE SURGICAL TREATMENT OF ACUTE PELVIC INFECTIONS IN WOMEN

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There is an unnecessary mortality and a prolonged morbidity attending pelvic infections in women, both preventable by timely and adequate laparotomy. It is estimated that 75 per cent. of the invalidism in women arises from pelvic infection. They suffer from pelvic, abdominal, and back pains, disorders of menstruation, constipation and its consequent toxemia, reflex digestive disorders and all grades of neurasthenia and the expression of focal infection in every form—cardiac, vascular, renal and arthritic; recurrences at intervals of acute exacerbations of the original infective processes within the pelvis, requiring prolonged courses of expectant treatment, during which time an ever-extending and encroaching pathological destruction either causes death or confirmed invalidism. It is especially with these acute exacerbations and with the primary attacks that this paper deals. It is to urge earlier and more radical operative treatment.

An experience covering twenty-five years of observation and surgical treatment of pelvic cellulitis and infections, recalls the days when the curet and all of its harmful effects was a menace in the hands of the surgeon and doctor. It was used indiscriminately for diseases of the uterus and adnexa. Following its use, patients were invariably kept in bed for three weeks by the physician, and in many instances three

months as a result of the curettage. During this ninety-day period, pelvic abscesses frequently formed and were drained through the cul-de-sac, the opening being kept patent either by gauze packs where the hemorrhage was free, or glass or rubber drainage tubes. Then, some months or years afterwards radical surgery was done, and not until then were these women relieved of chronic invalidism. The recurrence of pelvic abscesses after drainage through the cul-de-sac was the rule, and going into these abdomens months afterwards and finding still the pelvic mass with its pockets of so-called sterile pus was convincing that in the beginning the puncture of the cul-de-sac drained but one of the many pus pockets in the pelvis.

As a result of the unsatisfactory experience with the then approved methods of conservatism, the plan of waiting until these patients either died or cooled off into chronic invalidism prompted me to do very radical surgery on these cases whenever they came for treatment. However much the cul-de-sac bulges with pus, they are operated through a median lower abdominal incision, where all diseased tissue can be examined and treated surgically. Especially is it regretted that the accepted dictum today, "Not to operate during the acute stage," is followed unreasonably without either discretion or discrimination. The cause of the non-operative or expectant plan now in vogue is not far to seek. It is from the failure to follow known surgical principles in operating within the female pelvis, and is disastrous in its fatal results because the knife does not excise all diseased tissue and the small wick drain fails to execute its purpose; the original nidus, infection atrium, remains. The cocci grow and invade the lymph and blood-stream. The patient succumbs. Anesthesia and surgical shock with the opening up of fresh areas for infection and absorption without removing the source of it indeed, causes death more often and most reasonably so than if these traumata are not added to take away the remaining powers of resistance.

It will be seen from the series of reports and from the outline of the histories that the pus pockets by no means regularly become sterile. It is more reasonable that the individual acquires a temporary immunity; as this is gradually lost there results a recurrent exacerbation of acute inflammation with a further destruction of tissue and impairment of health. Many of these cases years after the onset of the infection will be brought in with an acute spreading or general peritonitis. We have detailed two cases who eight years after the onset were operated on during an acute exacerbation with general peritonitis.

The greatest error in my opinion in the operative treatment of these cases is the insufficient surgery and inadequate drainage. The principles laid down by Joseph Price and his successor, Kennedy, reach the highest degree of efficiency when applied to suppurative pelvic peritonitis. It is claimed that both the morbidity and mortality consequent to radical surgery in this condition is frightful. The reverse of this is my experience, and a review of the literature on this subject contributed during the last decade is convincing that at least the morbidity following the non-operative, the expectant plan, and the conservative-surgical is frightful indeed. It is the purpose of the essayist to express a formula crystallized by experience into a somewhat definite plan for the management of these cases.

Immediate operation is done in all presenting the symptom-complex of the acute surgical abdomen, if first seen within twelve hours after the onset of the infection, which is ushered in by sudden severe abdominal pain, nausea, vomiting, chill, elevated temperature, irritable bladder, rectal pain, constipation, abdominal rigidity and tenderness—all progressive, uninterrupted and accompanied by a definite leukocytosis. It is especially advantageous that the operation be done before the expiration of the first twelve hours; a period of safety for patients and one difficult for diagnostic differentiation with the surgeon. If first seen twelve or more hours

after onset, a varying period of some hours of observation is followed, during which time absolute rest is given the patient, as compatible as possible with the routine and repeated examinations. A blood count is done to determine the resistance of the patient and the severity of the infection; bacteriological examinations to ascertain the type of the bacteria with which one is dealing. As a rule, there are two of genital origin, the streptococcus and the gonococcus, and two of intra-abdominal origin from diverticulitis or appendicitis the streptococcus and the colon bacillus; other admixtures of bacteria are subsequent to or coincidental with the three named. The patient herself is taken into account more considerately than the laboratory findings concerning her. The most minute and painstaking examination employing all means at one's command for determining definitely the pelvic organs involved and the degree of involvement, not omitting a search for remote, coincidental, or complicating diseases, *x*-ray and cystoscopic examinations figuring prominently; pulse and temperature, noting especially disparity between them; the expression of the face, condition of the tongue, distention of abdomen, amount of vomiting or degree of nausea, the severity of pain, and the general appearance of well-being or lack of same, the activity of skin and kidneys, the relative difficulty of obtaining bowel evacuation, the passing of gas, and the changes that each few hours bring in any or all of these. During this time, the patient is supported by proctoclysis and hypodermoclysis of saline solutions containing glucose.

Defer operation: 1. If the condition is apparently stationary or symptoms are taking a more favorable turn during the six or twelve hours consumed in the preliminary study of the case.

2. When the blood examination reveals a high polymorphear count without an accompanying leukocytosis or in the absence of an increasing number of leukocytes, *pari passu* with the appearance of the polymorphears with each subse-

quent three or four hour total count. This is important for a high polymorphear count with a relative leukopenia indicates an intense infection in a subject with little or no resistance, one probably so overwhelmed that a fatal issue is to be expected regardless of any and all treatment.

3. From the third to the seventh day after onset when the fury of the peritonitis is at its height, giving rest method a chance to have effect, which is evidenced by improvement of symptoms, then the operation should be withheld in the absence of an exigency till the acute general symptoms have subsided.

Do not defer operation: 1. In the presence of a progressive exaggeration of unfavorable symptoms during the period of rest, observation, and expectant treatment.

2. On the occurrence of sudden relief of pain with a subjective sense of improvement, accompanied by an acceleration of pulse-rate and frequently by a lowering temperature, usually indicating thrombosis, or rupture of a localized abscess.

3. When a sudden fall occurs in a previously high leukocyte count or a decreasing number of leukocytes and an increasing percentage of polymorphears, which indicates a falling resistance.

4. When more than one week has elapsed since the onset of the infection, for the blood during this period of time will have developed in all probability a degree of immunity to the limit of its opsonic power.

5. The appearance of a mass in the pelvis, evidence of the localization of the infectious process by adhesions within a circumscribed area.

It is most frequently more than a week after the onset before the patient is referred to the surgeon and a pelvic mass is almost invariably found in these, and for such a delay of more than twelve or twenty-four hours for examination and preparation for operation is all that is usually required.

Laparotomy is done through a median lower incision.

Abdominal pads or rolls of dry gauze pack off the non-adherent intestines and non-invaded portion of the abdominal cavity. In the course of a great many operations done on these cases, it is found that the sooner these operations are done after the onset of the infection the less dense are the adhesions, the more easily the diseased adnexa can be separated, and the shorter the convalescence. The fundus of the uterus is the landmark. It is hugged by the dissecting finger in the line of cleavage between the adherent mass and the uterus, bladder and broad ligament. Blunt dissection is done, cutting only the more resistant bands till the dissecting finger reaches the cul-de-sac; the ends of the tubes usually found on the pelvic floor are freed, then from below upward, the finger sweeps laterally from the posterior surface of the uterus over the surface of the broad ligament, feels and liberates the adherent tube and ovary and lifts them into the operative field. In the intraligamentary types of abscess the adhesions of intestines and omentum to the mass are separated, the broad ligament incised between the round ligament and Fallopian tube, affording access to the pyogenic wall, which may be dissected out with the finger, frequently without rupturing it. Should it appear that hysterectomy is advisable, the broad ligament is clamped close to uterus down to reflection of bladder, the utero-vesical fold is incised and bladder freed from uterus and cervix by blunt dissection. In subtotal hysterectomy a cone is excised from the cervical stump, including the glands and cervical mucosa. If a total hysterectomy is to be done, a tenaculum forceps catches the vagina close to cervix and another the lower end of cervix; the vagina is then opened between the two tenacula and cut from the cervix uteri at its reflection. The uterus is then removed by incisions with knife or scissors close to clamps on broad ligament. The ovarian and uterine arteries are ligated individually, if exposed; if not, by mattress sutures through broad ligament close to clamps. If the patient is under thirty-five years the best ovary is left, if it is not infected.

The vaginal opening is closed by a lockstitch or interrupted figure-of-eight of No. 2, ten or twenty-day, chromic catgut. A running lockstitch of same is carried on either side of cut broad ligament. As soon as clamp is removed the edges are inspected for active bleeding; additional figure-of-eight sutures are employed to effect complete hemostasis, and the raw edges of both broad ligaments are united with a running lockstitch or interrupted mattress suture. The entire pelvic floor is covered with iodoform gauze overlaid with rubber dam, if denudation is extensive; if not, rubber gloves with strips of gauze run through fingers after cutting off tips are used.

If the abscess is intraligamentary, the front layer of the broad ligament only is stitched to its opposite and the posterior left free, thus making its cavity one and continuous with the denuded pelvic floor. The abdominal gauze pads are now removed and counted. Omentum and intestines are allowed to fall forward and downward touching rubber which overlies gauze. The omentum, which frequently has been ligated in sections on its lower border in freeing it from the mass, is carefully laid in its normal position in the abdomen, never drawn down nor tucked around the rubber and gauze drainage. In no case is the rubber drain removed before the seventh day. Where the drain is voluminous, and this is the rule, it is simply loosened up after a week, and during the next three or four days a gradual complete removal is done. As soon as the patient is anesthetized, hypodermoclysis of saline and glucose is commenced and one or two quarts introduced. Before the peritoneum is closed one or two quarts of hot water is given per rectum as suggested by Clark, and the sigmoid and colon freed from kinks or twists as they are filled.

Post-operative treatment: Head of bed elevated; continuous proctoclysis of tap water for twenty-four hours, and thereafter of glucose, soda, and saline, interrupted every six hours by rectal flushing and siphonage; in the more severe

cases hypodermoclysis of glucose and saline one quart every eight hours is administered. When nausea and vomiting is excessive, gastric lavage is done every six to eight hours. Morphin or codein with atropin is given hypodermically in sufficient doses to relieve suffering and afford rest and sleep. Water by mouth is withheld or in restricted amounts, an ounce every hour till vomiting stops, when it is increased; liquid nourishment is withheld until vomiting and nausea cease. The bowels are moved on the fourth day by purgatives and enema.

Conclusions. Failure to remove the focus of infection renders the operation relatively valueless; the source remaining, it is to be expected that the fury of the infection will increase and the involvement of contiguous structures and remote metastases will more certainly result.

Pelvic debridement is urged, in that pyogenic membrane with infected tubes, uterus, and ovaries should be removed.

Gauze packs over denuded pelvic surfaces to stop oozing and to hinder capillary absorption, thus limiting further extension of the infection.

Eroded or denuded intestinal surfaces are peritonized, or overlaid with the omentum.

Rubber dam covers the gauze packs and the pelvic operative field, minimizes the formation of adhesions, and drains freely and continuously.

The gauze and rubber ends are brought out through the lower end of the incision, and transfixed with a safety pin.

The abdominal incision is closed in layers and snugly around the drains.

The dressings over the incision should be voluminous, and changed as often as soiled to keep up capillary suction.

The results which have followed this plan are: the saving of life, shortening to a marked degree the post-operative period of recovery, the elimination of a prolonged morbidity, the relatively earlier restoration to health, and the resumption of the normal activities of the woman.

Summary of Case Reports

In three years there have been 255 pelvic inflammatory cases operated consecutively. Of this number one died. In the series there were eighty hysterectomies, the death occurring in this class. There were seventy-six double salpingectomies. Of those who had either one tube or one ovary, or one tube and one ovary removed there were ninety-eight. No subsequent pregnancies occurred in this number.

One hundred and sixty-three have been followed up, the longest period for three years, the shortest four months. Of this number one hundred and thirty-seven (or eighty-four per cent.) are cured; that is, in good physical health and free from symptoms. Eighteen (or eleven and one-tenth per cent.) are improved; eight (or four and nine-tenths per cent.) not improved. In this number there are included even those who are not improved for other reasons, *e. g.*, two of them are goiter cases, goiter developing since operation.

Thirty-one had double oöphorectomies done. Twenty-six (or eighty-three and five-tenths per cent.) were entirely cured of symptoms; three (or nine and six-tenths per cent.) improved; two (or six and nine-tenths per cent.) not improved It is noticeable that the percentage of cures in cases who had both ovaries removed are relatively the same as those who had one or none removed. Hospital days average 23.3, excluding one neurotic who spent 109 days in hospital.

The case reports herewith appended are the one hundred and sixty-three cases, whose post-operative course has been followed. They were compiled by Dr. D. H. Doherty from his service at Burwell's Hospital and from my service at the Vaughan Memorial Hospital, both in Selma, Alabama. The following complete case histories are illustrative of the four usual types:

1. Miss M. G., age thirty-eight years, single. "Abdominal pain, nausea, vomiting." About nine years ago says that she had an attack very similar to this, and that she had a

vaginal operation with drainage. Was in the hospital one month. Since then has had three or four similar attacks, though she has gone for a year or longer without one. Appetite and digestion poor. No nervous symptoms. Menses irregular, and nearly always painful. No bladder trouble. Lost 15 pounds in weight. Two days before admission had abdominal pain, fever, nausea, and vomiting. Has been unable to retain any nourishment. Bowels constipated. Thin emaciated woman. Very anemic in appearance. Conjunctivæ pale. Teeth good. Tonsils slightly enlarged. Temperature 101, pulse 86, respiration 24. Neck, chest, extremities negative. Abdomen, not distended. Very tender over both lower quadrants. Definite muscle rigidity. Urethra and cervix normal in appearance, and feel. On bimanual palpation the uterus feels normal in size, slightly movable. A mass about the size of a lemon is felt on the left side, and a mass somewhat smaller is felt on the right side. Blood: white blood cells, 8700; polynuclears, 80 per cent. mononuclears, 20 per cent.; negative for malaria. Urine: acid, specific gravity, 1016; albumin plus; no sugar; microscopic pus 3. Blood-pressure: systolic 115; diastolic 75. She was treated expectantly in the manner above described. Five days after admission: temperature 103°, pulse 124, respiration 28. Urine negative. Blood: white blood cells 11,600; polynuclears, 92 per cent.; mononuclears, 8 per cent.; Widal negative. Blood culture negative. Wassermann negative. She went to the operation on this day with the diagnosis of acute double salpingitis. Operation: Gas ether anesthesia. Hypodermoclysis of glucose and saline. Lower midline incision. A double salpingitis with a large infected left ovary, size of an orange found. Right ovary also infected, very slightly enlarged. The appendix was long and its tip bound to the right pelvic mass. Both tubes, ovaries, and appendix removed. Iodoform and rubber glove drain. On section both tubes and left ovary filled with grayish colored pus. Drain was gradually removed. On

sixteenth day was completely removed and tube inserted. Drained for six days longer. Dismissed thirty-eighth day completely healed.

2. Mrs. McD., aged twenty-two years, housewife. "Pain in abdomen, rigors, fever, vaginal discharge." Usual diseases of childhood. Never severely sick before present illness. Married. One child two weeks old. No miscarriages. Menses began at sixteen years, normal and regular. Two weeks ago was delivered of a normal child by her country physician. Two or three days afterwards began to have high fever, rigors, pain in abdomen. Occasional nausea and vomiting. Bowels have been constipated. Rather emaciated nervous woman. Face flushed. Lips dry and cracked. Tongue dry. Temperature 105.5; pulse 140, respiration 40. Head, neck, chest, and extremities negative. Abdomen: scaphoid shaped, not distended. On palpation lower quadrant was very tender, with marked muscle rigidity. No masses felt. Cervix lacerated, edematous, and red, with a grayish mucopurulent discharge. Urethra normal. On bimanual palpation the uterus appeared movable. Large tubes were felt. Bladder showed a mild grade of cystitis. Ureteral orifices normal. Catheterized specimen from each was free from pus. Blood: white blood cells 17,400; hemoglobin 75 per cent.; polynuclears 86 per cent.; mononuclears 12 per cent.; transitionals 2 per cent.; malaria negative. Wassermann negative (subsequent). Urine: acid, specific gravity 1020. Albumin plus; no sugar; microscopic examination, pus cells. Examination of specimen obtained by catheterized kidneys; no albumin; microscopic negative. Blood-pressure: systolic 120; diastolic 115. Diagnosis: puerperal infection, Operation, following morning of admission: Gas oxygen anesthesia. Hypodermoclysis of glucose and saline started. Lower midline incision. On opening abdomen a small amount of turbid fluid found. Intestines packed off. Uterus enlarged, red, and soft. Both tubes swollen and of a fiery red color. Both tubes and uterus re-

moved by technic described above. Iodoform gauze and rubber glove drain. Three days after operation temperature came down to normal. Discharged from hospital on eighteenth day.

3. Mrs. P., aged thirty-eight years, housewife. "Pain in stomach, fever, nausea." Usual diseases of childhood. About eight years ago had an attack very similar to the present one and since that has had several; does not remember how many. Has been very nervous and irritable, unable to do ordinary housework on account of weakness. States that she has a continuous pain in her back. Appetite and digestion poor. Bowels constipated. Menses irregular and painful. Has had leukorrhea for several years. At times has burning on urination. Has three children. Youngest nine years old. No miscarriages. Lost 20 to 25 pounds in three or four years. Began two days before admission with pain in lower part of abdomen. Pain was very severe and cramp like in character. Has been nauseated and vomited since onset. Bowels have not moved. Patient is a thin emaciated woman. Cheeks flushed. Seems to be suffering very much. Temperature 102, pulse 130, respiration 30. Head, neck, chest, and extremities negative. Abdomen, slightly distended. On palpation there is marked tenderness and muscle rigidity throughout, more marked in lower quadrant. On account of tenderness and rigidity, palpation was very difficult. Vaginal: cervix shows an old laceration. Definite whitish mucous discharge. Perineum relaxed. Urethra normal in appearance, no discharge. On bimanual palpation a definite mass can be felt on both sides, seems bound down. Uterus is retroverted. Cul-de-sac is bulging. Blood: red blood cells 4,000,000; white blood cells 7400; hemoglobin 35 per cent.; polynuclears 75 per cent.; mononuclears 24 per cent.; transitionals 1 per cent.; negative for malaria. Wassermann negative (subsequent). Urine: specific gravity 1020. Negative for sugar and albumin. Microscopic examination negative. Blood-pressure: systolic 118;

diastolic 80. Diagnosis: acute exacerbation of a chronic pelvic cellulitis. Operation, morning following day of admission. Gas ether anesthesia. Hypodermoclysis of glucose and saline started. Lower midline incision. On opening the abdomen a quantity of turbid fluid escaped. The intestines and peritoneum were violently red, showing a general peritonitis. The omentum and loop of the intestines were found firmly adherent to a pelvic mass. By the technic described above the omentum and intestines were freed; tubes and ovaries brought into field of operation. Tubes were very red, swollen, and contained pus. Total hysterectomy and salpingectomy was done. Right ovary left in. Iodoform gauze and rubber glove drain. Closed. For first week drainage was very abundant. Drain loosened on tenth day, being gradually removed. Complete removal sixteenth day. Patient discharged from hospital twenty-seventh day. Had gained twelve pounds in weight and felt fine.

4. L. L. M., colored, aged nineteen years, single. "Pain in abdomen and swollen joints." Has always been well until present illness. Usual diseases of childhood. No indigestion. Bowels regular. No sore throat nor tonsillitis. Menses began at fifteen years, regular. Began day before admission with pain in lower part of abdomen. Somewhat more severe in right side than left. Pain very severe. No vomiting, though nauseated. Urination frequent and very painful. The night before admission fingers and left wrist became swollen and painful. About two months ago states that she had bladder trouble, that is frequent and painful urination. Well nourished negro girl, who was evidently in pain. Tongue coated. Teeth good. Tonsils normal. Pharynx normal. Temperature 102, pulse 100, respiration 24. Neck: no glandular enlargement. Chest: heart and lungs negative. Abdomen: slightly distended. On palpation extreme tenderness throughout entire lower portion, with marked muscle rigidity. No masses felt. Left wrist and joints of first two fingers of left hand swollen, hot, and

tender. Vaginal: on inspection cervix is red. Bartholin's glands easily palpable. Mouth of urethra red and swollen. On bimanual palpation a definite mass is felt on each side of the uterus, which is bound down and adherent. Cul-de-sac slightly bulging. Blood: white blood cells 10,800; red blood cells 4,800,000; polynuclears 82 per cent.; mononuclears 16 per cent.; transitionals 2 per cent. Wassermann negative. Urine: acid, specific gravity 1016. Albumin and sugar negative; microscopic examination pus cells. Smear from urethra shows Gram-positive and negative diplococci. Gonorrheal salpingitis and arthritis. Operation: day after admission: Under ether. Hypodermoclysis of saline started as soon as patient was anesthetized. Midline incision. On opening abdomen omentum was found to be bound down to the pelvic organs. By the technic described the tubes were delivered into field of operation. They were very red, swollen, and covered with flakes of fibrin. The left ovary was enlarged and of a purplish-gray color. Both tubes and left ovary removed. Appendix removed. Iodoform gauze overlaid with rubber glove as drains. Closed. On the fourth day swelling in wrist and fingers had disappeared. Drain removed by eighth day. Dismissed seventeenth day, wound completely healed and free from symptoms.

CASE REPORTS

Name.	Operation.	Days in hospital.	Result.
Mrs. A. W. L.	Left salp. oöp. app.	17	Cured.
Mrs. G. J.	Double salp. hyst. app.	22	"
Mrs. G. B. E.	" " " "	28	"
Mrs. D. S. McK.	Hyst. left oöph. (tubes and appendix rmvd. prev. oper.)	18	"
Mrs. C. D.	Hyst. left oöph.	27	"
Mrs. H. W. H.	Double salp. left oöph. app.	27	"
Mrs. I. H.	Hyst. rt. oöph. double salp.	13	"
Mrs. C. L. Y.	Rt. salp. oöph. app.	14	"
Mrs. H. L. P.	" " "	18	"
Mrs. E. M. P.	Double salp. rt. oöph. app.	13	"
Mrs. W. C. McD.	Double salp. hyst.	24	"
Mrs. J. K.	" " app.	25	"
Mrs. R. S.	Hyst. rt. oöph. app.	36	Improved.
Miss B. G.	Right salp. oöph. app.	30	"
Mrs. J. W. K.	Double salp. hyst.	24	Cured.
Mrs. B. B.	Rt. salp. oöph. app.	18	"
Miss A. F.	Double salp. hyst. app.	24	Not improved.
Mrs. W. C. H.	" " " "	21	Improved.
Mrs. W. N. E.	Double salp. oöph. app.	16	Cured.
Mrs. E. P.	Double salp. hyst. app.	21	"

Name.	Operation.	Days in hospital.	Result.
Mrs. L. L. S.	Double salp. left oöph.	31	Improved.
Mrs. G. T. W.	" " app.	39	"
Mrs. C. J. E.	" " "	19	Cured.
Mrs. I. F.	" " " hyst.	36	"
Mrs. J. M. N.	" " "	41	Improved.
Miss R. W.	" " hyst. lt. oöph. app.	24	Cured.
Mrs. G. W.	Right salp.	19	"
Mrs. J. T. T.	Double salp. app.	14	"
Mrs. C. W. I.	" " " hyst.	28	"
Mrs. J. C. L.	" " " "	24	Improved.
Mrs. W. E. B.	" " " "	20	Cured.
Mrs. C. L. C.	" " "	25	Improved.
Mrs. G. F. W.	Double salp.	18	Cured.
Mrs. J. D. B.	" " app.	28	"
Miss M. L.	" " "	16	Improved.
Mrs. A. J. M.	Rt. salp. hyst. app.	13	Cured
Mrs. F. M. D.	Double salp. hyst. app.	31	"
Mrs. W. H. D.	" " " "	23	"
Mrs. S. G. P.	" " " "	32	Not improved.
Mrs. H. A. W.	" " " "	33	Cured.
Mrs. G. W. F.	Rt. salp. oöph. app.	19	"
Miss E. B.	Left oöph. app.	17	"
Mrs. W. R. W.	Double salp. hyst. app.	27	"
Mrs. P. M. C.	Right oöph. app.	25	"
Mrs. S. H.	Double salp. oöph.	24	"
Mrs. O. M. R.	" " app.	21	"
Mrs. M. B.	" " "	21	"
Mrs. R. L. L.	" " " left oöph.	26	Improved.
Mrs. F. C. K.	Left salp. oöph. app.	23	Not improved.
Mrs. J. M. C.	Double salp. hyst. app.	46	Cured.
Miss M. G.	Double salp. oöph. app.	41	"
Mrs. D. A. M.	Double salp. app.	26	Improved.
Mrs. M. M. C.	Double salp. app.	32	Cured.
Miss A. L. A.	" " " left oöph.	19	Not improved.
Mrs. B. M.	" " "	19	Cured.
Mrs. D. G.	Right salp. oöph. app.	14	"
Mrs. W. R.	Right salp. oöph. app.	13	"
Miss M. F.	Right oöph. app.	13	"
Mrs. F. D.	Double salp. hyst.	15	"
Miss B. D.	" " " app.	20	Improved.
Miss F. G.	Right salp. oöph. app.	13	Cured.
Miss W. K. P.	" " "	23	"
Mrs. C. R. C.	Left. salp. oöph.	16	"
Miss L. R.	Rt. salp. double oöph. app.	11	"
Mrs. J. W. R.	Double salp. oöph. hyst. app.	21	"
Mrs. R. J.	" " " " "	22	"
Mrs. R. H.	" " " "	20	"
Mrs. H. A. D.	" " " " "	31	Improved.
Mrs. F. W. M.	Left salp. oöph. app.	18	Cured.
Miss A. B. H.	Right oöph. app.	12	"
Miss W. H.	" " "	14	Improved.
Mrs. W. I. S.	Double salp. lt. oöph. hyst.	31	Cured.
Mrs. L. N.	Left salp. app.	15	"
Mrs. J. W. O'B.	Right oöph. app.	18	Improved.
Mrs. J. H. B.	Double salp. rt. oöph.	21	"
Mrs. T. H. B.	" " hyst.	22	Cured.
Mrs. W. P. N.	Left oöph. app.	16	"
Mrs. I. P.	Double salp.	16	"
Mrs. J. P. N.	" " oöph. hyst. app.	24	Not improved.
Mrs. E. E. H.	" " "	36	"
Mrs. J. W. R.	" " app.	16	Cured.
Mrs. T. H. M.	" " oöph. hyst. app.	40	"
Mrs. W. M.	" " hyst. app.	21	"
Mrs. J. S.	Left salp. oöph. app.	20	"
Mrs. W. H.	Double salp. hyst. app.	39	"
Mrs. W. H. McG.	" " " "	14	"
Miss M. C.	" " lt. oöph. app.	15	"
Miss O. W.	" " hyst. app.	18	"
Mrs. O. B. F.	" " " "	23	"
Mrs. E. J. P.	" " lt. oöph. app.	21	"
Miss A. L. B.	Rt. salp. oöph. app.	109	Not improved.
Mrs. G. C. T.	Left salp. " "	54	" "
Mrs. S. E. R.	Double salp. oöph. app.	29	Cured.
Mrs. D. C. D.	Left salp. oöph. app.	30	"

Name.	Operation.	Days in hospital.	Result.
Miss A. B.	Double salp. hyst. oöph.	58	Cured.
Miss T. E. C.	" " left oöph. app.	41	"
Mrs. N. M. S.	" " right oöph. app.	22	Improved.
Mrs. W. H. B.	Left salp. oöph.	48	Cured.
Mrs. W. M. B.	Double salp. hyst. app.	33	"
Mrs. R. N. M. G.	" " "	18	"
Mrs. D. G. C.	" " oöph. "	18	"
Miss G. S.	" " "	21	Improved.
Mrs. L. M. M.	Rt. oöph. "	18	Cured.
Mrs. R. L. H.	Rt. salp. oöph. app.	23	"
Mrs. J. A. R.	" " " "	23	"
Miss R. D.	Left salp.	23	"
D. E.	Double salp. hyst. app.	19	Cured.
T. A.	" " oöph.	24	"
E. R.	" " "	19	"
L. C.	" " hyst. app.	18	"
P. W.	" " oöph.	21	"
I. B.	" " "	17	"
A. L.	" " hyst. app.	21	"
M. D.	" " oöph.	21	"
P. S.	" " hyst. app.	21	"
S. R.	" " oöph. app.	17	"
L. P.	" " " "	21	"
P. S.	" " lt. oöph. hyst. app.	21	"
M. G.	" " oöph.	17	"
M. M.	" " hyst.	21	"
E. W.	" " "	23	"
S. H.	" " oöph. app.	21	"
M. J.	" " hyst. app.	21	"
B. C. L.	" " " "	21	"
G. B.	" " oöph. app.	21	"
S. P.	" " " "	21	"
B. M.	" " " "	18	"
S. B.	" " " "	21	"
E. W.	" " hyst. "	22	"
F. A.	" " oöph. "	27	"
H. D.	" " hyst. "	17	"
M. O.	" " " "	32	"
A. J.	" " oöph. "	24	"
D. M.	" " hyst. app.	26	"
L. M.	" " hyst. lt. oöph. app.	21	"
M. F.	" " oöph. app.	17	"
A. S.	" " " "	14	"
S. A.	" " oöph. "	19	"
C. S.	" " "	20	"
L. W.	" " left oöph.	29	"
E. B.	" " app.	17	"
L. H.	" " rt. oöph. app.	32	"
M. M.	" " lt. oöph. "	24	"
I. McW.	" " rt. oöph.	21	"
M. S.	" " oöph. app.	18	"
L. C.	" " lt. oöph. app.	21	"
E. M.	" " "	23	"
G. R.	" " "	33	"
M. M.	" " hyst. "	21	"
C. H.	" " rt. oöph. "	18	"
L. W.	" " " " hyst. app.	21	"
C. D.	" " hyst. app.	21	"
M. F.	" " " "	21	"
H. B.	" " " rt. oöph. app.	31	"
S. S.	" " oöph. app.	17	"
A. P.	" " rt. oöph. app.	18	"
T. H.	" " rt. oöph. app.	23	"
A. C.	" " hyst. app.	21	"
S. C.	" " oöph. "	21	"
W. L.	Lt. salp. oöph. app.	21	"
A. W.	Double salp. hyst. app.	24	"
R. E.	" " " lt. oöph. app.	24	"
M. E.	" " " app.	21	"

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REPORT OF A LARGE OVARIAN CYST IN AN INFANT SEVEN MONTHS OF AGE

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The report of a single case of ovarian cyst in an infant is presented partly to call attention to an unusual condition, but more especially for the purpose of making a plea for earlier operative interference in the surgical diseases of infants and children.

The literature contains reports of a large number of tumors of the ovary in children, including simple cysts, dermoids, sarcoma and carcinoma. Only two instances, however, have been previously recorded in which the condition was operated upon in the first year of life. That the two cases hitherto reported in young infants as well as the author's case were simple cysts and were first noted at birth or shortly afterwards suggests that this type of growth may reach considerable size in the fetus, and that the earlier in life these tumors make their appearance the better the chances are that the growth is benign rather than malignant.

In a resume of the 60 cases of ovarian tumors occurring in children ten years of age and younger reported up to 1904, Weil[1] states that 21, or 35 per cent. were dermoids; 19, or 31.6 per cent. cysts, single or multilocular; 15, or 25 per cent. sarcoma, and the remainder carcinomata or papillomata. Twenty-six cases under the age of ten have been recorded since Weil's report was made. Two were simple cysts, 8 dermoids, and 16 malignant—either carcinoma or sarcoma.

Fig. 1.—Appearance of patient, aged seven months, with ovarian cyst.

Fig. 2.—Appearance of patient, aged ten months, after operation.

The youngest recorded case of malignancy in an infant is one year and eight months, and of a dermoid two years. In studying the statistics of the 60 cases reported prior to 1904 it will be seen that more than 66 per cent. are classed as benign and 32 per cent. as malignant, whereas of the 26 cases recorded since that date, 62 per cent. are classed as malignant and 38 per cent. benign. The probable explanation for the apparent discrepancy in these findings is due to the fact that a more careful and thorough microscopical examination was made in the later series. Donhauser[2] of the Bender Laboratory in 1906 called attention to the importance of making a careful histologic study of all so-called simple cysts of the ovary with the view of deciding the question of malignancy. A comparison of the pathologic findings in the early and late series of cases quoted above proves the value of this author's suggestion. Furthermore it is clearly shown that any tumor of the ovary, cystic or solid should be removed as soon as possible after its discovery, as there is nothing in the early clinical history of most of the cases to indicate whether the condition is benign or malignant. As naturally expected a swelling in the lower abdomen is as a rule the first sign or symptom to call attention to the fact that the infant is suffering from an ovarian tumor. This may be observed at birth or soon thereafter. However, in many of the recorded cases acute abdominal pain due to twisting of the pedicle was the first symptom noted. The history of a number of the cases states that a previously healthy child begins to run down and show constitutional symptoms before the presence of a growth is made out. This generally suggests malignancy. Other symptoms are those due to the presence of the mass in the abdomen and vary according to the size and consistency of the tumor. Due to the fact that the uterus and its appendages are practically abdominal organs in early infancy, pressure symptoms on the bladder and rectum are seldom met with. In the case of solid growths especially if accompanied by adhesions there may be disturbance of the bowels, pressure

on the ureters or bladder and ascites. The growth may reach such proportions as to interfere mechanically with respiration and the general comfort of the patient. On the other hand it is surprising how little the simple cystic tumors may interfere with its nutrition. The fact that the infant takes its feedings well and seems to thrive in spite of the presence of a large cystic tumor favors very much the absence of malignancy. In older children the early appearance of or an irregularity in menstruation has been noted—more especially in the malignant cases.

Of the complications of ovarian tumors torsion of the pedicle is by far the most common. This accident is most likely to occur in the growths of moderate size, and is recognized by a sudden onset of acute abdominal pain which may be accompanied with rapid increase in the size of the tumor. Suppuration due to infection through the blood stream or lymphatics or as a result of aspiration has been observed. Rupture of the cystic growths has also been reported.

The diagnosis of ovarian tumors in infants offers several difficulties. In the first place the condition is so unusual that the examiner may not give due consideration to the possibility of the existence of such a disease. These growths are abdominal rather than pelvic and are usually attached by a long pedicle. For this reason they are easily mistaken for kidney tumors, mesenteric cysts, etc. If, however, the mass occupies the midhypogastric region and rectal examination suggests the presence of a pedicle giving a cord-like feel to the finger the diagnosis may be readily made. In the case of large cystic tumors occupying almost the entire abdominal cavity a general consideration of the condition of the patient will be of great value. The appetite may be good, bowels and kidneys function normally and the infant seem to be suffering merely from the mechanical presence of the large amount of encysted fluid. *X*-ray examination by means of a barium meal or enema is of great diagnostic value in determining the relation of the intestine to the growth. The

question of an exact ante-operative diagnosis is, however, of little consequence as compared to the importance of early removal and for this reason valuable time should not be wasted before resorting to an exploratory incision.

It is superfluous to state that the treatment of ovarian tumors, or for that matter, any abdominal tumor in an infant, is surgical. The case may be brought too late to permit of a cure either on account of the poor condition of the child or the histologic structure of the growth, but this does not alter the fact that surgery at the proper time offers the only hope of cure in such cases. The feeling that young infants do not stand major surgical operations well is still far too prevalent. Such is not the case. If these patients are given an equal chance with an adult—that is, early and correct diagnosis, are properly safeguarded from undue exposure and loss of blood during operation, they will make an even better and more rapid post-operative convalescence than older individuals. No thoughtful, properly trained physician or surgeon in this day would think of prescribing a cathartic for an adult giving symptoms of an acute abdominal condition before a careful study is made of the case. The same cannot always be said of the treatment accorded infants partly because of the inability to define their symptoms, but largely because the same degree of care is not exercised in making the diagnosis, especially at the very beginning of the disease. When the patient comes to operation and the result is not satisfactory the explanation is that infants do not stand operations well. In the case here reported a swelling of the abdomen was noted at birth which steadily increased in size, but it was not until the seventh month that a surgeon was consulted and then on the advice of an osteopath.

The history of the author's case is as follows: G. P., born February 13, 1920. Admitted to the Babies' Hospital September 24, 1920, with a history of enlargement of the abdomen, present since birth. Full term infant, normal

delivery, weight 9½ pounds. During the first three months the baby suffered from colic, and occasional loose stools with mucus. Took feedings well and did not vomit. General condition continued good and infant seemed well in every way except for the increasing enlargement of the abdomen. The abdominal distention was thought to be due to Hirschsprung's disease until *x*-ray examination demonstrated a normal intestinal tract.

Examination on admission to the hospital showed the patient to be well-developed and well nourished. Bright, not fretful, and apparently comfortable in spite of the enormously distended abdomen. Chest measured 15 inches, abdomen 24 inches, length 25 inches. Weight 17 pounds. Abdomen symmetrically enlarged. A definite fluid wave and fluctuation easily made out. Dulness extended over entire abdomen and into the flanks. On rectal examination a pedicle could be felt anteriorly and to the left. Anteoperative diagnosis: Ovarian cyst.

Operation September 24, 1920. Lower right rectus incision. No free fluid in peritoneal cavity. Large moderately thick-walled cyst. Trochar introduced and 2.5 liters of clear straw-colored fluid withdrawn. Pedicle size of little finger springing from left cornu of uterus ligated with number 1 plain catgut. Right tube and ovary normal. Abdomen closed in usual way. Convalescence uninterrupted. Discharged from the hospital October 7, 1920, cured. Pathological examination by Dr. Martha Wollstein showed simple ovarian cyst. No evidence of malignancy. December 3, 1920, mother reports that baby appears normal in every way and is gaining rapidly in weight.

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DISCUSSION ON THE PAPERS OF DRS. DUBOSE AND DOWNES

Dr. Randolph Winslow, Baltimore, Maryland.—It may be of interest to Dr. Downes and to the Association to know of another case, not as young as the one case of Dr. Downes, but a child aged eighteen months, which two years ago was operated on by our former colleague, Dr. Hundley, of Baltimore. I saw the child before operation and had the opportunity of examining her. It was a colored child, who had a large mass in the right side of the abdomen, and which was variously diagnosticated as kidney disease, kidney tumor and perhaps other things, but it was not diagnosticated, or suspected to be, an ovarian tumor. She was not ill in any way, as Dr. Downes has said. She was operated on, and much to the surprise of Dr. Hundley it was discovered to be an ovarian tumor. My impression is that it was a dermoid tumor, with a long narrow pedicle, which was ligated in the usual manner, and the child made a perfectly smooth and satisfactory recovery.

Dr. E. Denegre Martin, New Orleans, Louisiana.—I wish to report the following case for Dr. F. W. Parham: A child, aged five months, with a large tumor which proved to be retroperitoneal teratoma. The tumor was removed through an incision in the right rectus muscle, was found behind the posterior peritoneum and an incision was made through the posterior peritoneum, two edges of this incision being brought up to the anterior peritoneal incision and sutured. The tumor was then removed with the peritoneal cavity entirely shut off. The child made an uneventful recovery and was alive some months later, but after that the child was lost track of because the parents had left the state.

Dr. W. A. Bryan, Nashville, Tennessee.—Dr. Downes mentioned a point in his paper which is interesting, that is, there is a little dread on the part of most members of the profession not to operate on these little patients, as they do not tolerate surgery as well as adults. This is a mistake. I had a case some ten years ago of a doctor's child that had spina bifida, and the membrane covering it was as thin as tissue paper and very translucent. He brought the child to me in a basket

when it was eighteen hours old. He sent word to the office that he had a patient he wanted me to see. I sent the office girl down for the patient and she could not find him, yet the infant was in this basket. We operated on the child, closed the spina bifida, which required an hour to do the work, and the child was taken home that afternoon by the father in the same basket. I saw the child not long ago; he is now ten years of age, and is a big, husky youngster. The child had no bad symptoms during the operation or after it and made an uninterrupted recovery. I had another case of large umbilical hernia in a newborn babe. The hernia was covered with a thin membrane. We operated on the child at the age of thirty hours, made a closure, and I am told the child recovered, but whether that is true or not I do not know. However, the child went through the operation without any difficulty.

Dr. Downes (closing the discussion).—I should like to say a few words in reference to the anesthetic. Our President suggested the local anesthesia was probably contra-indicated in infants. Last spring I reported a large series of pyloric stenosis cases operated under ether anesthesia. At the suggestion of Dr. Bevan, who discussed the paper at the time, we have tried local anesthesia, and since that time have operated on 9 cases, selecting only the cases in poor condition. Of these 9 babies, all in poor shape, 8 survived and 1 died, and that baby would have died without operation. After giving them a few drops of paregoric beforehand I was surprised at the ease with which the operation was done. Infiltration of the abdominal wall, layer by layer, is all that is necessary. There is no pain in handling the tumor or the visceral peritoneum, nor any difficulty in sewing up the peritoneum. After Dr. Bevan's discussion I felt that local anesthesia was worth trying, and I am convinced he is correct about it. However, I still believe that when a baby is in good condition ether is the anesthetic of choice.

KRAUROSIS VULVÆ AND INGUINAL ADENITIS OF A MALIGNANT NATURE

By Francis Reder, M.D.
St. Louis, Mo.

The 2 cases of kraurosis coming under my observation present the singular interest that in both instances a malignant degeneration was demonstrable. The one case exhibited a malignancy of the left labium with involvement of the left inguinal glands; the other case presented a malignancy in the region of the fossa navicularis encroaching upon both the right and left labium and involving the glands of the right and the left inguinal region.

Both women were married, were respectively fifty-one and fifty-four years of age and had passed the menopause without ever having been pregnant. The general health has always been good and only in latter years did the bodily weight take on an appreciable increase.

Itching of the vulva and a leukorrhea had existed for about four years. The itching was of an intermittent character, at times mild and then again almost intolerable. The leukorrhea also showed periods of variability, these being characterized by an almost complete cessation or a marked profuseness. It was noticed that whenever the leukorrheal flow was slight the itching and burning about the vulva was much diminished. A severe attack of itching usually presaged a copious discharge. These patients felt more comfortable with a leukorrhea of moderate severity.

In this condition Mrs. F. drifted along for two and a half years when she was compelled to consult a physician on account of great pain caused by coitus. An ulcer was discovered by her physician which was treated with "most everything" including roentgen-ray therapy. The condition grew worse, the ulcer growing to the size of a 25-cent piece in about four months. Excision of the ulcer was then undertaken. Nine months later the patient noticed a lump in her left inguinal region. This mass gave evidence of rapid growth. It was on account of the inguinal condition that my advice was asked.

The second case, Mrs. S., sought medical advice only after severe pain made coitus impossible. An examination disclosed conditions about the vulva which were interpreted by the physician as changes that naturally followed the menopause. This patient was treated locally with lotions and ointment. An examination four months later showed a well-developed ulcerative area in the region of the posterior commissure. This was cauterized and treated with *x*-ray radiation. Under this treatment the ulcerative area encroaching upon both the right and left labium did not appear to enlarge, neither did it show any disposition to heal. About six months after the cauterization of the ulcer patient felt a pain in her left groin. Placing her hand upon the site of pain she felt a small tumor. At the same time she made an examination of her right groin and there also discovered a swelling. My advice was sought with reference to the inguinal enlargement.

The clinical picture of these 2 cases presented the evidence of the Breisky syndrome in its extreme characteristics with the addition of a typical cancer degeneration. In both a burning and smarting sensation was present. There was a malodorous discharge from the infiltrated cancerous ulcer. The ulcer was irregular in outline and presented itself as a dirty granulating sore. Its tendency was to spread along the mucous surface toward the vagina, then outward over the skin and the labium. The mucous surface had lost its

normal characteristics. It appeared a dead-white, thickened, smooth and dry. About the surface there were scattered four to six reddish and brownish spots, which when touched were very sensitive. No glans clitoris nor any labia minora were present, these structures having become obliterated during the progress of the disease. The ostium vaginæ was abnormally narrow and appeared as though it had become cicatricially stenosed. An attempt to introduce the index finger into the vagina caused bleeding and much pain. Atrophic changes seemed to have taken place in the labia majora, and the mons veneris. A partial alopecia was apparent.

In the case of Mrs. F. a tumor the size of a tangarine occupied the left inguinal region. The case of Mrs. S. presented a tumor the size of a hen's egg, in the right and the left inguinal regions. Both women were able to be about and felt fairly well. In the analysis of these 2 cases it can be demonstrated that the course of the disease ere it terminated into the stage of cancer, a degeneration fortunately not often encountered, passed through three distinct pathologic phases: pruritus, leukoplakic vulvitis and kraurosis.

A simple pruritus vulvæ which is usually present in an innocent way for many years, can undoubtedly be responsible for subsequent morbid changes involving the mucosa of the external genitals. Trauma to the epithelium of the vulva inflicted upon the burning and itching areas for relief is the precipitating factor in producing a low grade infection of the underlying connective tissue. An exudation of plasma occurs, the result of tissue reaction. The continued infection followed by exudation and infiltration causes edema, and this is seen clinically as engorgement, softening and lividity. Eventually the affected area loses its normal color, becoming pale and dry, assuming the appearance of parchment. The vulnerability of the impaired structures becomes great on the slightest provocation and an added traumatism, such as a fissure, may engender a more severe form of pruritus which might finally develop into a leukoplakic vulvitis.

It is reasonable to assume that not in every instance does a leukoplakic vulvitis follow a pruritus. The pruritic stage may merge into the condition of kraurosis without a leukoplakic lesion. In kraurosis, however, where a cancer degeneration has taken place, the presence of a leukoplakic vulvitis must be accepted, inasmuch as there is no tendency to a malignant degeneration in kraurosis. There is, however, a tendency to a primary cancer of the vulva in leukoplakia. A leukoplakic vulvitis is a disease which occurs in women past the menopause and is due either to natural atrophy of the glands at the time of the normal menopause or else to their surgical removal. The histologic changes are located in the epidermis and consist primarily of an absorption of elastic tissue from the uppermost layers of the corium over a portion or all of the vulva internal to the hairy portion of the labia majora (Taussig). The absence of elastic tissue invites trauma with a resultant low grade infection of the underlying connective tissue. As the disease progresses the affected areas become covered with thickened epithelial plaques, whitish in color. These plaques may cover more or less fully the entire area diseased.

Kraurosis, the last of the trinity, is a chronic infection the result of repeated traumatism with low grade infection, usually occurring in women after the menopause. The fact, however, must not be overlooked that in younger women factors favorable to its production are found in a postoperative menopause. The three lesions have much in common and it can reasonably be assumed that a kraurosis is the final chapter to the damage done to the tissues by the lesions which invariably precede it. The characteristic state in which the vulva has been transformed by these extreme pathologic processes has suggested the name kraurosis. It is a word "coined" from the Greek κραυρος, meaning "dry."

In kraurosis the histologic changes are situated in the dermis and usually present a general atrophic process involving the entire vulva, with marked contraction of the vaginal

orifice. Not infrequently the glans clitoris and the labia minora have disappeared and the ostium vaginæ has become narrowed to such an extent that an attempt to introduce the index finger, if at all possible, is causative of great pain. Some cases frequently show atrophy of the mons veneris with complete alopecia. A patient afflicted with this disease is often a great sufferer, and not only is coitus very painful, but the itching and burning is frequently almost unbearable. The assumption that the pathologic process of kraurosis vulvæ can be accepted as an inherent primary disease appears to me still strongly lacking in corroborative evidence.

A critical analysis of the clinical picture of pruritus and leukoplakic vulvitis discloses so many features in common with kraurosis that the inference could be made that kraurosis is an expression of a severe degree of these lesions, and that without pruritus and leukoplakic vulvitis there would be no kraurosis. The term "kraurosis vulvæ" can, therefore, be conveniently accepted as a lesion secondary to the pathologic processes excited by pruritus and leukoplakic vulvitis, depicting the clinical picture of the impaired vulvar tissues in their most distressing condition. A kraurosis vulvæ degenerating into malignancy is as rare as a kraurosis lesion itself. This is very fortunate inasmuch as vulvar carcinoma demands an extensive operative measure, even though the relief afforded be of short duration. The mortality in cancer of the external genitals is high because of the frequency with which the tributary glands are involved early in the disease.

Just why cancer should be of rare occurrence in a kraurosis vulva is difficult to explain. The necessary factors conducive to malignancy are present, and present for a long time, the irritation and the debilitating influences caused by prolonged suffering are plainly apparent and the law that carcinomata have a predilection for surfaces where a transition takes place from one variety of epithelium to another is fairly well applicable to this condition; yet carcinoma as a sequela to kraurosis is said to be infrequent. Nevertheless a patient afflicted

with kraurosis should be safeguarded against any possible malignant changes, and the lesion subjected to a measure radical in its execution. This measure is an operative one and consists in the complete excision of the affected area.

In the earlier stages before the clinical picture becomes pronounced and an intense pruritus apparently is the only existing condition, the source of the irritation should be sought and, if possible, removed. An intense pruritus not amenable to treatment is a condition which justifies excision of the areas involved. When the lesion presents itself as a pronounced kraurosis and is associated with a leukoplakic vulvitis, an association not at all infrequent, we should appreciate the experience of others who have subjected these conditions to radium and roentgen-ray treatment. The results of these treatments have been most disappointing and in frequent instances have caused much suffering to the patient. In three instances Taussig used raidum with only temporary improvement after a period of extremely painful radium reaction. In the hands of the same observer, roentgen-ray and radium treatment in cancer of the vulva have given most unsatisfactory results. Some investigators recommend in the more pronounced kraurosis with dyspareunia an incision widening the vaginal outlet. I would advise against this procedure as it has little to recommend. It has no beneficial influence upon the condition, and does not prevent a subsequent contraction of the ostium.

Reverting to the 2 cases with infiltrated cancerous ulcers and metastases in the inguinal glands, a radical excision was made in each instance. The operation pertaining to the inguinal dissection requires a technic of much delicacy and is somewhat severe. An operation of this character cannot be a satisfactory one unless all inguinal glands are removed, especially important ones situated deeply around the femoral vessels. Such a dissection requires the division of Poupart's ligament.

The relief these patients obtained was most gratifying.

Up to date they are free from any of their former suffering, with no evidence of any recurrence. The operations were performed respectively nine and eleven months ago, a time allowance too brief in the consideration of recidivation.

DISCUSSION

Dr. Charles L. Bonifield, Cincinnati, Ohio.—Such an excellent paper as this should be discussed because it deals with a comparatively rare condition. One thing that impressed me as rather remarkable is that Dr. Reder has seen only two or three cases of kraurosis vulvæ. While it is comparatively rare I feel sure I have seen quite a few more than that number, and I am inclined to think he has seen others that have not been so severe, and he has not called it kraurosis.

Dr. Reder (closing the discussion).—I feel that Dr. Bonifield is quite correct in regard to this matter. The case I saw with Dr. Dorsett presented the extreme characteristics of kraurosis. The condition is also known as climacteric dyspareunia, the interpretation of this expression meaning painful coitus during the menopause.

TUBERCULOUS ULCER OF THE ANTERIOR VAGINAL WALL WITH RESECTION OF ULCER*

By Ernest K. Cullen, M.B.
Detroit, Mich.

Tuberculous ulceration of the vagina is only occasionally observed. It may be the sequel to extensive peritoneal and pelvic tuberculosis. Rarely, however, is the vagina the only pelvic structure involved, and to this group shall we alone refer. Those cases which have been reported show in nearly every instance an associated or preëxisting pulmonary tuberculosis.

Namias[1] in 1861 reported a diffuse tuberculous ulceration of the vagina and bilateral pulmonary tuberculosis in a prostitute. Klob[2] in 1864 reported a case showing at autopsy tuberculosis of the lungs, tuberculous ulceration of the intestine, tuberculosis of the liver and tuberculous ulceration of the vagina. Deschamps'[3] patient, aged twenty-five years, showed tuberculous ulceration of the vulva and vagina, tuberculous ulcer of the hand and bilateral pulmonary tuberculosis.

Pitt[4] in 1887 reported an interesting case of a small ulcer of the vagina and I shall present his report verbatim: "There is a single irregular ulcer one-sixth inch across, with loss of mucous membrane, one-fortieth of an inch deep, situated three-fourths of an inch from the os uteri on the anterior wall of the vagina. The floor is irregular, the margin at one spot is

* From the Department of Gynecology, Harper Hospital.

undermined. When fresh the margins were extremely congested and swollen, but there was no infiltration and no signs of adjacent tubercles. The ulcer was fairly recent and not healing. Ulcers in the upper part of the vagina, excluding malignant and traumatic, are uncommon. None are recorded in the transactions of this Society. The patient in whom this ulcer was found had been in the hospital in bed for four months previous to her death, suffering from phthisis. Post-mortem. Numerous tubercular ulcers were found in the intestine and larynx."

Zweigbaum[5] in 1888 reported a case of old pulmonary tuberculosis with associated tuberculous ulceration of the vulva, vagina and portio vaginalis. Havas[6] in 1897 reported a case of tuberculous ulcer of the introitus vaginæ.

I present the following case as one of special interest from a clinical, pathological and operative standpoint:

History. L. S., married, aged thirty-seven years, admitted to Harper Hospital March 22, 1920. For four years the patient has complained of recurrent attacks of dull aching pain in the lower abdomen, and during the past six months has complained of irregular vaginal bleeding. For the past six weeks this bleeding has been slight in amount but constant. She has had also increased frequency of urination during the daytime and occasional smarting sensation in the vagina. The patient, her husband, and a son eight years of age, have been in the Tuberculosis Department of the Herman Kiefer Hospital for two years. The patient and her husband are suffering from pulmonary tuberculosis, and the son from tuberculosis of the right hip joint. The husband on careful examination has shown no evidence of urogenital tuberculosis. Blood Wassermanns were taken on both the patient and her husband, a positive reaction being reported in each instance. From their histories, however, we have been unable to obtain any clinical evidence of lues. Relying solely upon the positive Wassermann reaction both had been given salvarsan and mercury. The patient had

typhoid fever at sixteen and pneumonia at twenty-five. Her menstrual history has been perfectly normal. She was operated on sixteen years ago for a right ruptured extra uterine pregnancy. She gave birth to a full-term child, thirteen years ago; the child living, however, but three days. She had a second child born eight years ago. Both labors were normal. A therapeutic abortion for a three months' pregnancy was performed in June, 1919.

General physical examination of the patient on March 23, 1920, shows moderately active bilateral pulmonary tuberculosis.

Abdominal examination was negative, except for slight pain on deep palpation over the left lower quadrant.

Vaginal Examination. The outlet is marital with some relaxation. There is a scant bloody vaginal discharge. The urethral orifice is normal. On introduction of the examining finger into the vagina it immediately comes in contact with a roughened area on the anterior wall. Manipulation of this causes some bleeding, but the patient suffers very little discomfort. The cervix is normal in size, points backward, and is perfectly smooth. The fundus is normal in size, in anteposition, but movement is restricted. The appendages on the right side are free. Occupying the left fornix is a small cystic mass approximately 5 cm. in diameter, which is movable but tender on manipulation.

On examination of the vagina with the speculum an irregular punched out ulcerated area (Fig. 1) measuring approximately 6 x 4 cm. is found on the anterior vaginal wall beneath the base of the bladder and extending a slight distance downward along the urethra. The margins of the ulcer are hard and elevated about 2 mm. above the base. The latter presents the typical apple jelly appearance with fine bleeding points on manipulation.

Smears taken from the ulcer and examined with the dark field illumination were negative for spirochetæ. Smears were also negative for tubercle bacilli.

Fig. 1.—Tuberculous ulcer of anterior vaginal wall (natural size). The ulcer measures approximately 6 by 4 cm. The margins which are firm are elevated about 2 mm. above the base. The latter presents the typical applejelly appearance of a tuberculous ulcer and on manipulation fine bleeding points are visible.

Fig. 2.—(Photomicrograph approximately 300 diameters.) This section taken from the margin of the ulcer presents the typical picture of active tuberculosis. The giant cells in this section are especially numerous.

The clinical laboratory findings are as follows: Urine examination: (Catheterized specimen) S. G. 1012, acid, pale color, cloudy, no sugar, no indoxyl, no bile, slightest trace of albumen. The centrifugated sediment which is slight contains a few squamous epithelial cells numerous pus cells, but no casts or blood. Examination for tubercle bacilli was negative.

Blood Examination: Hemoglobin 70 per cent. (Talquist), red cells 3,700,000, white cells 14,000.

Differential White Cell Count: Polymorphonuclear cells, 74 per cent.; small mononuclear cells, 6 per cent.; large mononuclear cells, 17 per cent.; transitional cells, 3 per cent. A blood Wassermann showed a 4 + reaction. (There were no clinical manifestations of lues.)

Roentgenologic Report by Dr. William A. Evans: Plate of the chest in the posterior position shows no evidence of lower lobe pathology nor any evidence of pleuritis. There is increased deposit at the hilus on both sides and accentuation of the linear markings. There is evidence of a bilateral, parenchymal infiltration, this being seen more especially opposite the first and second interspaces on the right side, and opposite the first interspace on the left side. There is an area of increased density opposite the middle portion of the right hilus and also opposite the fifth interspace on the right side. The appearance is that of a well resisted parenchymal T. B.

Cystoscopic Examination. The bladder mucosa is normal in appearance except for some reddening over the trigonum. Both ureteral orifices are normal. There is no evidence of tuberculosis.

April 8, 1920, under gas anesthesia two small wedge-shaped pieces of tissue were removed from the margins of the ulcer. These on microscopic examination presented the typical picture of active tuberculosis (Fig. 2). Before attempting excision of the ulcer we wished to ascertain what curative results might be obtained by use of the roentgen ray

or radium. Before so doing, however, we decided to relieve the patient's abdominal symptoms.

Abdominal Operation, April 14, 1920, *Median Incision:* Examination of the pelvic structures shows the presence of a left cystic ovary 6 cm. in diameter and an adherent tube. The right tube is missing. The right ovary and uterus are normal. There is no evidence of tuberculosis of the pelvic structures. Scattered over the head of the cecum, however, are a few discrete and confluent tubercles. The appendix shows only slight chronic thickening. Examination of the other abdominal viscera shows no gross evidence of tuberculosis. The appendix and left tube and ovary were removed. On microscopic examination the tube shows chronic salpingitis, the ovary a corpus luteum cyst and the appendix a chronic catarrhal inflammatory process. No tuberculosis is evident at any point.

May 11, 1920, Dr. J. E. King subjected the ulcer to a maximum dose of roentgen ray. May 29, 1920, Dr. J. E. King inserted 50 mg. of radium into the vagina for a period of five hours. The patient was discharged from the hospital on June 1, 1920. July 15, 1920, a second similar-sized dose of radium was again given. September 12, 1920, the patient was again admitted to the hospital. The roentgen ray and radium had shown no appreciable effect on the ulcer and we decided to attempt excision.

Operation September 7, 1920: Dilatation and curettage, excision of ulcer. Dilatation and curettage were performed, but only a small amount of curettings was obtained. In order to facilitate removal of the ulcer and also to minimize damage to the bladder it was deemed advisable to make a vertical incision directly through the ulcer. The line of demarcation between the base of the ulcer and the underlying fascia was more definite than we had anticipated. The line of cleavage thus obtained made simple the removal of both portions of the ulcer, leaving a perfectly clean cut wound. The margins were then approximated with a con-

tinuous locking suture of No. 2 chromic catgut. Three stay sutures of the same material were employed. Catheterization showed the bladder uninjured. Following operation catheterization was ordered every eight hours until the seventh day to avoid any strain on the vaginal wall. Convalescence was slow but uneventful. There was some breaking down of the wound at the left upper angle but this soon healed by granulation.

Histological Report. Examination of the uterine scrapings shows a perfectly normal endometrium. Further sections from the ulcer show the same picture of tuberculosis as previously reported (Fig. 2). December 11, 1920. The wound has healed perfectly and the patient is free from any discomfort. The bladder condition is rapidly clearing up.

The salient features of this case are the following:

1. The tuberculosis seemed to be limited to the lungs, the head of the cecum and the anterior wall of the vagina.
2. The anterior vaginal wall was the only pelvic structure involved in the tuberculous process.
3. There was no evidence of urogenital tuberculosis in the husband.
4. The involvement of the vaginal wall appears to have been hematogenous in origin.
5. It was possible to resect the ulcer with subsequent healing of the wound.

In conclusion, I wish to express to my Resident, Dr. O. C. Foster, my appreciation for much of the clinical data obtained and to Dr. C. I. Owen, of the Pathological Laboratory for assistance in a study of the literature.

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REPORT OF A DIVERTICULUM OF THE FIRST PORTION OF THE DUODENUM

By Ernest K. Cullen, M.B.,
Detroit, Mich.

The study of the literature of diverticula of the duodenum has been so fully considered by Cole and Roberts,[1] and Case,[2] that I shall without further comment add this case to the list of those already reported.

History. W. B., aged forty years, married, referred by Dr. William H. Weir, of Cleveland, March 30, 1917. The patient has one child six years old. In 1913 she had a dilatation, curettage and trachelorrhaphy performed. A slight descensus of the uterus being present, a Smith-Hodge pessary was inserted. The patient came to me complaining of some discomfort in the right lower abdominal quadrant with associated nervousness and severe headaches. Her general physical condition was good. There was some tenderness on deep palpation over McBurney's Point. There was slight descensus of the uterus. Examination of the eyes was negative. The urine was normal. Tonic treatment was prescribed and the patient soon showed marked improvement.

On May 26, 1920, the patient again consulted me. She stated that, with the exception of some trouble with carious teeth one year ago, her health had been good until eight weeks

[1] Cole, L. G., and Roberts, D.: Diverticula of the Duodenum, Surg., Gynec. and Obstet., 1920, xxxi, No. 4.

[2] Case, J. T.: Diverticula of Small Intestine Other than Meckel's Diverticulum, Jour. Am. Med. Assn., 1920, No. 22, lxxv.

ago. At this time she had an acute attack of "gastro-intestinal grippe," and consulted my colleague Dr. S. C. Hanna. The onset of this attack was marked by severe vomiting, a rise of temperature to 102° and severe diffuse pain over the epigastric and gall-bladder regions. There was no jaundice and constipation was obstinate. The pain which persisted with some intermittence has assumed a boring-like character, most pronounced three to four hours after meals and is located just to the right of the median line. On light palpation considerable tenderness is elicited, but no definite spasm is present. There is also tenderness to a less degree over the gall-bladder area. The area of stomach tympany is not increased. There is very slight tenderness on deep palpation over McBurney's point.

The patient was referred to Drs. P. M. Hickey and William A. Evans for roentgenological examination and their report is as follows:

Roentgenologic Report. Survey of the chest shows the right and left lung fields clear. Heart slightly enlarged. No disturbance of the mediastinal shadows. Stomach of the extreme vertical type, shows good tone, the walls remaining strictly parallel during the examination. We are unable to fill the duodenal bulb by manipulation, with the patient in the erect position. Good single wave peristalsis starting at once on the ingestion of the meal. No evidence of an incisure.

Patient Examined Prone. The stomach is seen to be considerably dilated. There is marked two-cycle type of peristalsis, the waves being very deep and conspicuous. At times the duodenal bulb seems gigantic in its appearance, perfectly smooth, without evidence of distortion. The type of peristalsis, when considered in connection with the apparently normal bulb, would signify extragastric irritation. Serial plates will be made.

Survey at Five Hours. There is no evidence of a gastric retention. There is marked evidence of gaseous distention of the stomach and cecum. The barium is visualized in the ileum and is just beginning to fill the cecum.

Survey at Twenty-four Hours. Retention of the barium in a low, deformed cecum. Cecum too low to permit of manipulation. The patient, however, refers her symptoms to the upper right quadrant. In this region there is a mass of barium about the size of a hickory nut which seems to be sensitive to manipulation. At least, the area about this shadow is sensitive to pressure. Irregular outlining and relations of the colon.

Examination at Forty-eight Hours. Still retention in the cecum. Cecum elevated somewhat from the twenty-four hour appearance. Transverse colon ptotic, but can be elevated. The shadow noted above the colon in the upper right quadrant at twenty-four hours is still present. The mass is smaller, still sensitive to manipulation.

Plates of the urinary tract show no evidence of calculus. There is lumbarization of the first sacral segment, but there is no evidence that this has any clinical significance.

Serial Plates (Fig. 1) made following the ingestion of the meal show the stomach in active peristalsis, without gastric defect. There is a large duodenal cap. This shows a little irregularity on the external aspect. There is a mass of barium extending out from the outer aspect of the duodenum, which seems to push farther to the right the second portion of the duodenum, without causing duodenal stasis. *The appearance is that of a diverticulum of the duodenum.*

A plate made at twenty-four hours (Fig. 2) shows the position of the cecum and the cecal stasis as described in the fluoroscopic findings. There is a mass of barium opposite the transverse process of the fourth lumbar segment on the right side. This was the mass which was described in the fluoroscopic notes and which was sensitive to manipulation.

A plate at forty-eight hours (Fig. 3) shows still the small mass of barium opposite the transverse process of the fourth lumbar on the right side. The cecum is emptying somewhat, and shows elevation. No doubt the shadow described on the twenty-four and forty-eight hour plates as lying opposite

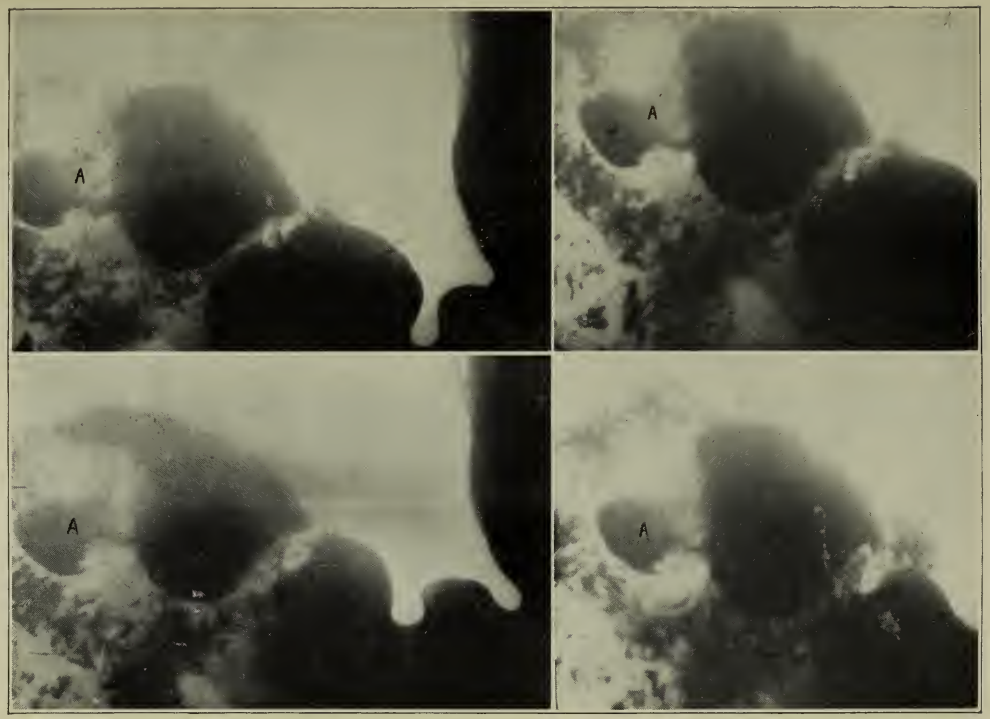

Fig. 1.—Serial roentgenograms taken immediately following the ingestion of the barium meal, showing a large duodenal cap with some irregularity on its external aspect. Extending outward from this is the mass of barium (*A*), which represents the well-defined diverticulum.

Fig. 2.—Roentgenogram taken twenty-four hours after ingestion of the barium meal, still showing retention in the diverticulum (*A*).

Fig. 3.—Roentgenogram taken forty-eight hours after ingestion of the barium meal, still showing retention in the diverticulum (*A*).

the fourth lumbar segment represents the shadow which was interpreted on the serial plates immediately following the ingestion of the meal as a diverticulum of the duodenum.

CONCLUSION. Duodenal diverticulum; disturbance in the position, outline and function of the cecum, probably secondary to adhesions.

Following the ingestion of the barium meal the pain was exaggerated and the patient suffered considerable discomfort for seventy-two hours. A limited diet was prescribed, but little relief experienced.

Operation: Harper Hospital, June 30, 1920. Release of adhesions. Posterior gastro-enterostomy. The upper abdomen was opened through a right rectus incision. The stomach walls were found to be normal and the pyloric orifice unobstructed.

The gall-bladder, duodenum and gastrocolic omentum were involved in adhesions, but the gall-bladder wall was not thickened nor were stones present. It was found that a small portion of the gastrocolic omentum had in turn become adherent to the anterior portion of the duodenum and the gall-bladder. In so doing it pulled the first portion of the duodenum upward causing a distinct sacculation. After separation of the adhesions had been completed, the first portion of the duodenum was found to be considerably redundant. There was no evidence of duodenal ulcer or other diverticula.

Consideration of the patient's symptoms, the undoubted damage to the duodenal mucosa by the retention of food in the diverticulum and the possibility of adhesions reforming, convinced me that the forming of a gastro-enterostomy would be the safest procedure. A posterior gastro-enterostomy was then performed. The appendix which was atrophic was not removed. Apart from discomfort resulting from infection of the abdominal incision, convalescence was uneventful.

Another roentgenologic examination was made on October 13, 1920, and is as follows:

Examination at 11 *A.M.* The first portion of the barium to reach the stomach passed rather quickly out through the posterior gastro-enterostomy opening. The opening appeared to be in the middle third. We attempted to force the barium up into the duodenum, but at no time was this structure outlined. After a delay of ten minutes, and in several positions, there was still no duodenal filling. The gastric evacuation by way of the new opening was slow.

Examination at 1.45 *P.M.* At least 80 per cent. of the barium meal has escaped from the stomach. No evidence that the barium was leaving by the normal route. The duodenum and cap were not well filled.

Examination at 4 *P.M.* Stomach practically empty, with apparent filling of the duodenal cap. The escaped barium has, in part, entered the large bowel. A plate of the upper right quadrant at four hours following the ingestion of the meal shows outlining of the duodenal cap. There is evidence of a small amount of barium in the second portion of the duodenum.

Examination at Twenty-two Hours. No barium detected in the upper right quadrant. A plate was made (Fig. 4.)

A report from the patient on December 1, 1920, states that she has been on an unlimited diet for several weeks, and is free from any epigastric pain or distress.

DISCUSSION

Dr. Edward P. Richardson, Boston, Massachusetts.—I have been very much interested in Dr. Cullen's paper on "Diverticulum of the Duodenum." Recently I had occasion to look over the autopsy records in some 4000 cases at the Massachusetts General Hospital, and these records showed that diverticulum of the duodenum was nearly as common as Meckel's diverticulum, occurring approximately once in 200 cases. These

diverticula were found ordinarily in the first or second part of the duodenum, being often of considerable size, and commonly with a large opening between the duodenum and the diverticulum. Whether these diverticula were the cause of the symptoms in these cases I do not know, but there was no evidence that the diverticula contributed to the fatal outcome.

REPORT OF TWO RATHER UNUSUAL SUBPHRENIC CONDITIONS

By Randolph Winslow, M.D.
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A subphrenic abscess is a comparatively rare condition; a subdiaphragmatic pyopneumothorax is still more unusual. The term subphrenic abscess is applied to any collection of pus situated immediately below and in contact with the diaphragm. As the liver occupies most of the space immediately below the diaphragm these abscesses are located usually between the upper convex surface of the liver and the under surface of the diaphragm. The falciform ligament divides the subphrenic space into two compartments, and forms a barrier to the spread of infection from one side to the other. The coronary ligament and its extension into the right and left lateral ligaments forms a partition between the anterior and posterior surfaces of the liver. Collections of pus may, therefore, occur in five areas: 1, right anterior; 2, left anterior; 3, right posterior; 4, left posterior and 5, between the folds of the coronary ligament. Abscesses in all of these areas are intraperitoneal with the exception of the fifth which is extraperitoneal. The causes of subphrenic abscess are numerous. The most frequent cause is probably appendicitis, the infection extending usually by direct continuity of tissue to the posterior right lateral aspect of the subdiaphragmatic space. Of almost, or quite, equal frequency are abscesses due to perforating ulcers of the stomach and duodenum; those on the lesser curvature of the stomach usually causing abscesses to the left of the falciform ligament, while

perforations of the duodenum cause abscesses to the right of this fold. Other causative agencies are cholecystitis, cholangitis, abscess of the liver, diseased conditions of the colon, spleen, kidneys and pancreas, residual abscess from peritonitis, external injury, disease of the ribs or spine, empyema and pneumonia.

The abscesses sometimes contain gas, in varying amounts, which may have gained entrance from a perforated hollow viscus or may have developed from the action of gas forming organisms.

The symptoms of subphrenic abscess are frequently obscure and the condition is, doubtless, often overlooked. The symptoms will vary somewhat with the cause and the seat of the disease. Chills, fever and sweating are often present, while pain and tenderness with hardness and rigidity of the affected region sometimes can be elicited. At times the area of liver dulness may be increased or it may be partially or entirely lost. An increased leukocytosis generally will be found. An *x*-ray examination should always be made, but the findings may not be conclusive or may be misinterpreted.

The treatment is incision and drainage, and this frequently involves a transpleural thoracotomy.

The object of this paper, however, is not to give an exhaustive description of this condition but to report 2 cases that have occurred in my service during the current year, which presented somewhat unusual features.

Case I. Pyopneumothorax Subphrenicus.—W. G., aged sixty-five years, was admitted to University Hospital on February 12, 1920. For three years he has had stomach trouble, consisting of attacks of pain and acidity, which were generally relieved by eating, or by taking bicarbonate of soda. At times he would have to take food in the middle of the night to relieve his distress.

These attacks have become more frequent and during the

past year vomiting has supervened. No blood, however, has ever been noticed in the vomitus. About ten days ago he was taken with more severe symptoms and the pains became spasmodic in character.

On admission his temperature was 101.4°, pulse 108 and respiration 28. The heart sounds were clear and normal. The lungs were somewhat emphysematous. On inspection the abdomen was seen to be distended in the upper zone, below the umbilicus it was rather flat. There was rigidity and tenderness in the right upper quadrant and in the epigastrium. The liver dulness was entirely absent. The pains continued and became more severe and vomiting occurred more frequently. An analysis of his stomach contents showed free HCl 36 per cent., total acidity 48 per cent., several analyses subsequently showed an even greater acidity. The blood count showed red cells 4,900,000, leukocytes 5600, polynuclears 69, small lymphocytes 30, eosinophiles 1, hemoglobin 85 per cent. Urea in the blood was 0.3 grams per 1000 c.c.

The Wassermann reaction was negative. The urine contained albumin and an occasional cast but no sugar; specific gravity, 1017. Clinical impression: gastric or duodenal ulcer, probably perforated and walled off.

Skiagraphic report: Small heart, displaced to left. Dome-like shadow in middle portion of right chest, arching from the mediastinum on a level with the eighth rib posteriorly upward to middle portion of chest, then downward to the axillary region. This shadow is about ½ cm. in thickness and corresponds in outline with the diaphragm, but it is about 3 inches higher than the normal position of the diaphragm. Below this shadow there is an area of increased density, homogeneous in appearance, which extends to the tenth rib and below this homogeneous shadow are areas of lesser density showing the presence of air. The upper border of the diaphragm is irregular in shape and shows the presence of several broad adhesions. The examination suggests an

old empyema with pneumothorax in the lower right chest. Notwithstanding this report, we held to the clinical findings and acted accordingly.

Operation: On February 16, under nitrous oxide and ether anesthesia an incision was made vertically through the right rectus muscle. The liver was found to be adherent around its edges to the abdominal parietes, which when separated allowed a quantity of gas to escape. This gas had a colon bacillus odor. There was but little pus but the surface of the liver was covered with a grayish exudate. The stomach was also bound down with dense adhesions. After breaking up these adhesions a small perforation was found on the lesser curvature of the stomach, which was closed with two rows of sutures and a posterior gastro-enterostomy done. Rubber tube and gauze wick drains were introduced.

Following the operation there was much drainage from the wound, moderate elevation of temperature and acceleration of the pulse but no vomiting or pain. He died, however, two days later with symptoms of general sepsis.

Autopsy report: the liver was large and extended three finger breadths below the costal margin in the right clavicular line. All the organs on the upper side of the abdomen were matted together. The diaphragm on the right side extended to the fourth interspace, on the left to the sixth. The upper surface of the right lobe of the liver was covered with a yellowish exudate. The peritoneum was glistening and was not inflamed. An ulcer was found on the lesser curvature of the stomach, which was leaking from a small opening.

The clinical history of this case is typical of gastric or duodenal ulcer and the cutting pains suggested that a perforation had occurred, while the absence of signs of peritonitis showed that the rupture was walled off by adhesions. The chief interest in the case depends upon the complete loss of liver dulness. It is a well known fact that many subphrenic abscesses contain gas, which may come from a perforated viscus or may be due to microbic action, but in this case the

whole liver area was tympanitic on percussion. The rest of the abdomen was not unduly resonant and was collapsed rather than distended. When the abdomen was opened no free gas was found in the general peritoneal cavity, but there was a large collection of gas encapsulated between the right lobe of the liver and the diaphragm, which was due to an ulcer on the small curvature of the stomach. This fact is also noteworthy, as perforations on the lesser curvature are said by most authors to cause abscesses to the left of the falciform ligament. The low leukocyte count (6500) is also striking. Another feature in the case was the misinterpretation of the skiagraphic findings, which suggested to the roentgenologist an encapsulated supraphrenic pneumothorax. The curved dome of the diaphragm being so far displaced upward that it was thought to be the condensed lower margin of the lung. A very similar picture is shown in the "Archives of Surgery," vol. i, No. 3, page 575, in which a curved shadow, which limits a pyopneumothorax above is lung tissue and not the diaphragm.

Case II. *Subphrenic Abscess—Possibly from an Abscess of the Liver.*—M. W., male negro, aged twenty-one years, was admitted to University Hospital, June 9, 1920. The present trouble began one week ago, suddenly, with giddiness and pain in the right side under the ribs. He says he had no cough or expectoration and that the pain was increased on deep inspiration. He is a healthy looking person who has never lived in the tropics or, indeed, out of Maryland.

Physical examination: On the right side there is decreased respiratory movement. On this side also both anteriorly and posteriorly the percussion note, from the third rib down, is markedly impaired becoming dull near the base. The breath sounds are diminished on the right side, becoming lost at the base. There are a few râles at the left apex and the whole left side of the chest is hyperresonant. At no time has he had chills. On admission his temperature was 102°, pulse

110, respiration 28. Under the impression that the case was an empyema an interne aspirated the chest and drew out pus.

Having a suspicion that the case might be one of abscess of the liver, I ordered an *x*-ray examination to be made, which showed a rigid diaphragm with a clear picture above the diaphragm and a cloudy one below, on the right side. The left lung was quite clear. There was absolutely no pneumonia in either lung. The urinary examination showed nothing abnormal. The Wassermann reaction was negative. Cultures from the aspirated pus grew out pneumococci and streptococci. No amebæ were found in the stools.

Operation, June 24, 1920: Nitrous oxide gas and ether anesthesia. An incision was made over the tenth rib in the posterior axillary region and about two inches of this bone was excised. The pleura presented and a small opening was made into it, which showed it to contain no pus. This opening was then sutured and the pleura was detached from the diaphragm. An opening was then made through the dome of the diaphragm and a large quantity of thick, almost gelatinous, pus escaped. The upper surface of the liver seemed to be rough and pitted. One rubber tube and three pieces of gauze were introduced for drainage. He did well, suffered but little and was out of bed in a short time. Drainage was quite free and eventually a considerable discharge of bile was established. A microscopic examination of the pus failed to show hooklets, scoleces or parasites, nor were any hepatic cells found.

The patient left the hospital with a sinus but returned to the dispensary for dressings. Early in September the external wound had healed and he went home, some distance in the country. About the middle of the month he was taken ill and died in a few days. His physician thought he had a recurrence of the abscess, but no autopsy was made and the cause of death remains in doubt.

I am inclined to think that the abscess in this case was extraperitoneal, that is, situated between the layers of the

coronary ligament, as the collection of pus was far back and no induration could be felt anywhere, nor was there any material pain or discomfort, after he came under my observation. The question of etiology is also interesting. Cultures from the pus showed pneumococci and streptococci, while both physical and x-ray examinations showed no evidence of pneumonia whatever.

Whether there was an abscess of the liver is problematical; the chief cause for suspecting that such might have been the case was the rather free discharge of bile subsequently and the fact that my finger detected a pitted and rough spot on the upper surface of the liver.

Lastly the differential diagnosis between an abscess situated immediately below the dome of the diaphragm and a low encapsulated empyema is attended with many difficulties. Aspiration is useful in showing the presence of pus, but is of doubtful value in determining its exact location. A skiagraphic examination is also of value. If the pus is situated below the diaphragm, the dome of this structure will be pushed up and it will be more convex than normal, while the clear lung will show above, if there is no fluid in the pleural cavity. By means of aspiration and the x-ray examination a reasonably accurate diagnosis may be made, but the exact location of the pus may await the surgeon's knife.

DISCUSSION

Dr. J. M. T. Finney, Baltimore, Maryland.—Just a word in reference to the diagnosis of these cases of obscure pus in the chest or abdomen. I can recall two cases in which the sign which Dr. Winslow refers to, that is, the high arch of the diaphragm, and to which so much significance is attached by x-ray men, surgeons and physicians was fallacious. They were both obscure septic conditions. I operated three times on one patient, a woman, for various conditions. She is still living and is the picture of health. I know what she did not have, but I do not

know yet what she had, and I wish somebody would tell me. That patient had a high arch of the diaphragm, two ribs higher than normal. Dr. Baetjer, whom I consider the equal of anyone in interpreting *x*-ray plates, said unhesitatingly she had a subphrenic abscess. The patient had clinical evidence of an obscure septic condition somewhere, and we were trying to locate it. There was nothing definite that we could find anywhere. I had previously operated on her for volvulus of the sigmoid. After excluding everything else, on the strength of the *x*-ray plate, we thought she had a subphrenic abscess. I went in under local anesthesia, opened the abdomen and there was not an adhesion between the liver and the diaphragm nor any sign of present or past infection. Why that diaphragm was high I do not know, certainly there was no abscess.

The other case was sent in with a diagnosis of probable abscess. An indefinite history led up to it. An *x*-ray taken of the arch of the diaphragm showed it to be unusually high. Dr. Baetjer also saw this case and said he would consider it a subphrenic abscess. I then went in and found nothing in the subphrenic region.

I mention these two cases simply to call attention to the fact that the sign to which we attach so much importance or significance in these cases, namely, the high arch of the diaphragm, may be fallacious, as it was in these two cases.

Dr. Fred W. Bailey, St. Louis, Missouri.—Subdiaphragmatic abscesses are usually on the right side. I recently had occasion to hold an interesting autopsy which will justify a report. The patient, a miner, had been working every day until the third day before he came to the hospital. He appeared with a large, fluctuating subcutaneous abscess over the left costal area. It was opened under local anesthesia and discharged a pint of very foul-smelling pus. The man's physical condition was not good and a more thorough examination was withheld until later. Locally I used Dakin solution, which controlled the discharge, but the man complained of tasting it in his mouth during and after irrigations. It was, of course, immediately discontinued. With the *x*-ray we were able to demonstrate that solution entered the abscess cavity through a sinus tract from the left fundus of the stomach, and coffee ingested would pass directly from the sinus into the dressings. He died six days after operation. Autopsy showed a very large gastric

carcinoma involving almost the entire fundus, perforating the fundus of the stomach on the left side. There was no history of his having at any time complained of gastric symptoms; he had worked daily, as long as he could remember, but from lack of nutrition recently lost weight. It was a spontaneous gastrostomy, practically without symptoms.

Dr. Winslow (closing the discussion).—In the first case the liver was adherent all around, so that it formed a cavity there, which was filled with air through a perforation in the stomach. It seems to me the case is unique.

FUNDAMENTALS OF THE PTOSIS QUESTION

By R. C. Coffey, M.D.
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To use a homely but practical definition, we may say that embryology is the science by which we are taught the construction of the animal organism. Anatomy teaches us the details of the constructed organism. Physiology teaches us the functions of the organism after it has been animated by the nerve and blood supply. Pathology we may use in its broadest sense by referring to any deviation from the normal as being pathological.

The development of the body cavity is as follows: (1) As soon as the ovum has been fertilized by the spermatozoön the cells begin to arrange themselves in characteristic divisions which later are to play an important part in the formation of the various structures of the body.

The principle divisions are the ectoderm, from which the skin and spinal canal are formed; the entoderm, from which the lining of the alimentary canal is formed; and the mesoderm, from which bones, muscles, ligaments, etc., are formed. The entoderm, which at first has a direct connection with the yolk sac very early fuses and the yolk sac disappears, leaving the straight intestinal tube seen in the early fetus and in lower animals. In the mesoderm two lateral cavities form, which later become the serious cavities of the body. In the abdominal part of the fetus, the space on each side of the intestinal canal is known as the celom. This is soon lined by a membrane which is later known as the peritoneum.

These spaces extend from the back to the front of the body of the fetus. Between the two spaces lies the intestinal tube. That part of the mesoderm between these two body cavities is gradually absorbed except such as is necessary to develop the muscular wall of the alimentary canal and the two lining membranes. Thus the intestinal canal lies between the two layers of menbranous partition which extends from the primitive spinal column to the primitive anterior wall of the fetus. That part of the partition in front of the primitive alimentary tract is known as the ventral mesogastrium. That part of the membrane lying back of the primitive alimentary tracts is known as the dorsal mesogastrium. Between the layers of the ventral mesogastrium the liver with its ducts develops, while between the layers of the dorsal mesogastrium the pancreas and spleen develop. The liver in the fetus is a very large organ. It rapidly develops between the membranes of this partition and expands in all directions, thus taking up the slack of the ventral mesogastrium and thereby shortening it. The duodenum is drawn upward and, as the alimentary canal develops, the stomach begins to grow backward between the layers of the dorsal mesogastrium and to form a curve. At this stage of development it will be noted that the lesser curvature of the stomach is directed toward the primitive anterior abdominal wall while the greater curvature is directed toward the spine. As the stomach and intestine increase in length their relations must of necessity be changed. The duodenum rotates to the right, until it comes in contact with the posterior parietal peritoneum on the right side where the contiguous surfaces fuse. This rotation of the duodenum to the right and to the back must necessarily twist that part of the ventral mesogastrium which extends from the liver to the stomach a half turn on itself. At the same time the stomach changes its relations. The dorsal mesogastrium elongates and this allows the stomach to change its position so that it rotates and slides toward the left side. That which

was originally the left surface of the stomach now becomes the anterior surface and the greater curvature which was directed toward the spinal column is now directed to the left and downward. That portion of the anterior mesogastrium between the liver and the stomach, instead of being parallel to the perpendicular axis of the liver now becomes parallel to the transverse or horizontal axis of the liver and its name is changed to the gastrohepatic omentum or ligament. The large intestine, with its mesentery, which is a part of the dorsal mesogastrium, moves upward, to the right and downward, and settles back in contact with the posterior parietal peritoneum. The small intestine, which was primarily on the right side of the body, now shifts to the left side. The peritoneum of the colon and its mesentery on the right side of the body and on the left side of the body comes in contact with the parietal peritoneum and the contiguous surfaces blend. Thus, that portion of the back of the adult abdominal cavity represented by the ascending and descending mesocolon is lined not only by the primitive parietal peritoneum seen in quadrupeds, but by all the elements of the mesentery of the colon as well. The ascending and descending colon have during this process become partially retroperitoneal organs, along with the kidney. A part of the transverse mesocolon fuses with the parietal peritoneum and with a portion of the anterior peritoneal surface of the duodenum. Thus the duodenum has two fused layers of peritoneum behind it and two fused and one unfused layer in front of it at its lower portion. The transverse mesocolon adheres to the parietal peritoneum only in part. The transverse colon is suspended by its mesentery from the fused areas. It is, therefore, freely movable and pendulous.

While these processes of rotation and fixation are taking place the great omentum, is growing down over the transverse colon where its posterior peritoneal surface adheres to the peritoneum of the colon and mesocolon, and gives the colon two more fused layers of peritoneum for a support. As

a further support to the transverse colon, the omental bursa normally becomes obliterated by the adhesion of its contiguous peritoneal layers, thus giving two more supporting peritoneal layers by the formation of the gastrocolic ligament. There is no true gastrocolic ligament until the omental bursa is obliterated up to the colon. In the dog, cat and other quadrupeds, the kidneys lie behind the one layer of peritoneum, and may be picked up and almost pulled out through an abdominal incision. This is made impossible in the human being by the additional support of the fused mesocolon with the parietal peritoneum. In case the colon has not completely rotated, as is true in a considerable number of human beings, the frail support of the kidneys, predisposes to floating kidney, as we shall see later.

It is often quite puzzling even to the doctor unless a good deal of study is given it, to fully understand the relation of the peritoneum to the various organs. I have often used the following homely illustration:

Let us suppose that we desire to line a room with cloth; that we expect the cloth to be loosely attached to the wall by elastic network or rubber bands. This network would correspond to the loose connective tissue outside the peritoneum, which hold it to the firmer structures of the abdominal wall. Then let us suppose, as an after-thought, we decide to suspend certain articles into the room without bringing them directly within the cavity. We, therefore, take a string and let down one article from the ceiling. It pushes the cloth immediately in front of it and the network behind and the cloth from the sides close in after the article. From the inside of the room the cloth is between the article and the free cavity of the room. Suppose, then, that we glue the cloth to this article on the outside. This part of the lining of the room will correspond to the peritoneal covering of the viscera within the abdominal cavity. The string suspending the article from the ceiling or sides would correspond to the bloodvessels, lymphatics and nerves going to

supply various organs in the abdominal cavity. That part of the cloth dropped down as a fold to include the string would correspond to the peritoneum of the mesenteries. Then it will be seen that the abdominal organs are really extraperitoneal, being let into the peritoneal cavity by infolding the peritoneum by pressure from without speaking from a purely mechanical standpoint.

This description corresponds exactly to the arrangement of the mesenteries and peritoneum of the quadruped. This has been modified in the human being by the fusion of certain peritoneal surfaces for the purpose of fixing certain organs for assuming an erect position. This seems to be a developmental process as man has raised to an erect animal.

In studying the abdominal cavity from the standpoint of comparative anatomy we find that in man the liver has fused with the diaphragm, while in the quadruped it is suspended by a mesentery the same as other organs. In man the duodnum is firmly fixed to the peritoneum of the right abdominal wall, while in the quadruped it is freely movable. In man the ascending and descending colon and the two flexures are normally fixed to the posterior abdominal wall without the intervention of mesentery, while in quadrupeds the large intestine has a long mesentery, and is, therefore, freely movable. In man the great omentum grows down over the transverse colon and adheres to it. This does not occur in the quadruped. In man the omental bursa is usually obliterated by adhesion of its layers together. Obliteration does not take place in the quadruped. In man the pancreas has been rotated behind the peritoneum and fixed to the abdominal wall. In quadrupeds the pancreas lies between the layers of the mesentery. In the monkey, which is a quadruped with a tendency to stand erect, the pancreas becomes adherent and the duodenum is more firmly fixed than in the original quadruped.

A question which confronts us is, why these differences between the animals walking on four legs and those walking erect? I believe these prenatal fixations by adhesion or fusion

in the erect animal are without doubt for the purpose of holding the organs in their places thus to prevent them from piling up in the bottom of the abdominal cavity by gravity.

I feel sure that if a dog were forced to walk upon his hind legs all the time without the normal peritoneal fusions noted in the human being his organs would pile up in the bottom of his abdominal cavity and he would become a "neurasthenic," as ptosis patients have usually been called.

While the suspensory supports of the peritoneum are very important, in fact essential in the holding of the abdominal organs into their proper position in order that they may functionate, this is not the only influence which makes it possible to hold the organs in their normal position. This is sufficient in the quadruped but in man we must bring in other influences to bear.

THE SHAPE OF THE ABDOMINAL CAVITY AND ITS RELATION TO THE PTOSIS QUESTION. The shape of the abdominal cavity is very much the same in all animals. In man the shape of the abdomen becomes a very important factor in maintaining the relative position of the organs. It must be remembered that the abdomen is not a straight oval but that the abdominal cavity proper, independent of the pelvis, is in the shape of a Bartlett pear tilted backward. The following is a detailed account of the study I made several years ago for the purpose of determining the exact shape of the abdominal cavity.

In order to get a perfect mathematical diagram of the abdominal cavity I have used the body of a man who died of pneumonia. The weight of the man was about 140 pounds, height five feet, eight inches. The table on which the body lay was leveled. The front of the abdominal wall was removed. The stomach and all the intestines except the base of the cecum and the appendix were removed. The liver, gall-bladder, kidneys, ureter and bladder were left and a string was pinned along the course of the ureter so as to make it prominent in the plaster cast. The body was made perfectly

level and the cavity was filled with a liquid plaster-of-Paris. Two days later the body was cut off the cast. The cast was then dried and painted with iodine to give it color and was covered with several coats of shellac to make a line of cleavage. The flat or abdominal side of the cast was then placed on the bottom of the box, so that the highest point of the cast was represented by the deepest point in the flank, and an inch of liquid plaster-of-Paris was poured in around the cast, at which time stakes were set to mark the lines for sawing after the cast had dried. On the right side, a line was made which would pass through the deepest point of the flank, the appendix, and the deepest part of the pelvis. This line would correspond to a line drawn from the center of the perineum to the tip of the shoulder. A corresponding line was made on the left side; a cross line was made to pass through the appendix transversely; another line through the lower poles of the kidneys; and still another line through the lower poles of the kidneys. The box was then filled with plaster, making a block 7 by 16 by 18 inches. This was dried and was sawed along each line. As each section was made, a draughtsman was present to make an accurate tracing of the cavity, which is shown in pictures in solid black. The plaster sections are checked off in sections corresponding to one inch. By these pictures it is seen that with the subject standing erect, if a plumb line were dropped from the diaphragm so that it passed through the abdominal cavity at the point where the appendix is attached to the posterior wall, much more than one-half of the space on that side of the median line would be back of the plumb line, which we will, for convenience of study, call the perpendicular psoas line. If another plumb line were dropped so as to pass along the front surface of the kidney this line would be 3 inches back of the perpendicular psoas line, and may be called perpendicular kidney line. Another line 1½ inches further back would touch the back side of the kidney. The attachment of the he-

patic and splenic flexures of the normal colon is external to kidney and is almost even with its posterior surface. This attachment is 4 inches back of the perpendicular psoas line, and passes from the hepatic flexure forward to the cecum or appendix at a 51 degree angle. It will be noticed by observing these lines that fully two-thirds of the right lobe of the liver is back of the perpendicular psoas line so that the really heavy organs are found not to drag with a direct pull at all. In fact, the kidney rests on a 4-inch shelf which is heavily padded with fat. It is held back by the normal retroperitoneal connective tissue plus the fused mesocolon with its two layers of peritoneum, connective tissue, bloodvessels, etc. Therefore, in a normal individual, there is not the slightest tendency toward prolapse of the kidney. The ascending colon lies on a shelf with a slope of 51 degrees, and is held there by fusion with the parietal peritoneum as mentioned previously. It would not, therefore, hang as a dead weight, even in the absence of intra-abdominal pressure. On the left side, the splenic flexure is held at a higher level and further back than the right, or hepatic flexure, and has two extra supports in the form of the costocolic ligament and the gastrosplenic ligament which is continued down to the colon. These organs are held on this shelf to a certain extent by the strength of the abdominal wall in front, much as if you should set a vessel on a shelf not quite wide enough to prevent it from falling off and should then nail a strip in front of it. The weight held by the strip would correspond to the part played by the anterior abdominal wall in holding up the abdominal organs. The abdominal wall, therefore, becomes the third element in holding the organs in position. In a normally well developed man standing erect a plumb line dropped from the tip of the shoulder blade should just about touch the buttock. Opposite the lower lumbar vertebra there would be a concavity in the back amounting to 2 or 3 inches. If an anteroposterior section is made through the flank of a normal man so as to

strike the edge of the kidney, the base of the appendix, and the edge of the pelvis, the section of the abdominal cavity when looking at it from the side is almost exactly the shape of a pear, the upper end corresponding to the large end of the pear, and the lower end, ceasing at the appendix, would correspond to the stem end of the pear. The pear, instead of standing erect on its small end, leans far back and rests on an inclined plane. It will be noted in this that the abdominal wall at the larger end near the diaphragm is very thin posteriorly, and the abdominal cavity is correspondingly large at this point, as indicated by a cross-section at the lower pole of the kidney, which represents a cross-section of the plaster cast. The area of this cross-section covers 44 square inches. At the base of the appendix the posterior abdominal wall is several inches thick. This thickness is produced by the curving forward of the spinal column at this point and the crossing of the psoas muscles from their attachment to the vertebral column to the iliac fossa. This line of the cross-section of the abdominal cavity at the crossing of the psoas muscle, which we have called the transverse psoas line, is 14 square inches. In other words the abdominal cavity is more than three times as large at the lower kidney line as it is at the transverse psoas or appendix line. The psoas muscle makes a very abrupt shelf. Above this is a large pad of fat. On this padded shelf the kidney, ascending colon, and a good portion of the liver rest. It will thus be seen that nearly all the heavy organs are located so that they rest principally on this shelf. The main reservoir of the stomach, the cardiac end, rests back in the left flank. The middle pyloric portion of the stomach and the transverse colon are the two notable exceptions to this rule. These organs must depend entirely on the direct suspensory supports, and upon the intra-abdominal pressure. Hence their great tendency to prolapse independently as set forth in the subsequent reference to midline ptosis. The principal muscles which form the third class of supports in holding these organs

on the shelves are the recti muscles, and the sheath or aponeuroses which they receive from the tendons of the oblique divide at the anterior edges of the recti muscles so that one-half of the fibrous structures go behind the rectus and one-half in front, where they meet and interlace, forming the linea alba.

Intra-visceral and Intra-abdominal Pressure. The fourth element of support connected with the abdominal organs is intra-visceral and intra-abdominal pressure.

The peripheral abdominal wall is a flexible structure, composed chiefly of flexible and elastic muscle enclosed in a flexible but non-elastic aponeurosis. While the wall is flexible to a large degree, it is collapsible only in its front portion. The collapsible portion, or anterior abdominal wall, contrary to the ordinary belief, is but slightly elastic under an ordinary acute strain, owing to the strong layers of aponeurosis surrounding the muscles. Except in chronic processes, such as the development of a tumor by cellular increase, a cyst or ascites, which has behind it the blood-pressure or pregnancy, there is but little change in the capacity of the abdomen of an otherwise normal person. Extreme distention of the abdomen may noticeably enlarge the abdominal cavity by pushing up the diaphragm at the expense of the chest capacity. By elevation of the ribs, the girth of the upper portion of the abdomen may be increased, but the lower or middle part of the abdomen will be correspondingly diminished. Elevation of the ribs plus extreme distention of the abdomen make tense and collapsible part of the abdominal wall, and increase the girth of the abdomen at all points; but the only actual increase of abdominal capacity is made at the expense of chest capacity by elevation of the diaphragm. The abdominal cavity is air tight, but is by no means a vacuum.

There is always a variable and indefinite amount of pressure in the peritoneal cavity, known as intra-abdominal pressure. This pressure may be greater, but is usually less

than the atmospheric pressure. The degree of intra-abdominal pressure depends on the variable contents of the abdominal cavity. The variable contents are (*a*) extraperitoneal and mesenteric fat; (*b*) the visceral contents. The visceral contents are liquids and gases and may be intermittently expelled at any time, this acting as an immediate safety valve for the establishment of an equilibrium and a normal intra-abdominal pressure. The extraperitoneal and mesenteric fat is included within the inelastic abdominal wall, and lessens the abdominal cavity in exact proportion to the amount of fat thus included.

The law of osmosis, by which fluids of different densities pass through an animal membrane and establish an equilibrium, has its counterpart in the relation of intra-abdominal and intra-visceral pressure. I made an interesting experiment as follows: An ordinary suction apparatus, connected with a water faucet by a rubber tube, which in turn is connected with an aspirating bottle by a T-connection, tends to create a vacuum in the bottle, provided the distal end of the horizontal portion of the T is closed. If it is not closed, the air is drawn directly through the tube from the outside, and the air in the bottle remains in a state of equilibrium. If a very thin rubber bag is suspended in the bottle by a hollow tube passing through the cork and connecting the bag with the outside atmosphere, the air within the bag and within the bottle remain in a state of equilibrium so long as the distal end of the T-connection remains open. If this distal portion of the T-connection is closed by forceps, suction at once begins to reduce the pressure within the jar and thus tends to make a vacuum. Immediately the atmosphere rushes into the enclosed, suspended rubber bag and distends it in proportion to the degree of vacuum thus produced in the jar.

Thus, a law parallel to the law of osmosis can be formulated: If a thin elastic container with an outside connection for a source of supply of fluids or gases is enclosed within an

inelastic container, there is a constant tendency to establish an equilibrium of pressure. Thus, if a portion of the contents, consisting either of gas or of other substance, is withdrawn from the outside, inelastic container, the pressure on the outer surface of the elastic container is reduced, and a corresponding inflow of contents is brought into the elastic container from the outside, for the purpose of establishing an equilibrium.

In the case of the abdomen, the abdominal wall is the outside, inelastic container, and the hollow viscera represent the inside, elastic container, with the outside source of supply through the mouth. Within, and partially filling the abdominal cavity, is a variable quantity of fat. Intra-abdominal fat is apparently deposited under much lower pressure than are the cells of a tumor, pregnant uterus or ascitic fluid. The deposition of fat, therefore, within the abdominal cavity does not materially stretch the abdominal wall in a normal person. However, it is sufficient to increase the size of an already existing umbilical or postoperative ventral hernia. If a large umbilical or postoperative ventral hernia exists for a long time in a fat patient, intra-abdominal fat is deposited in proportion to the contents of the hernial sac, making it difficult, and at times impossible, to replace the hernial contents without removing some of the abdominal contents such as the great omentum.

A patient, who has been moderately fat, for some reason loses flesh; the fat in the abdomen is correspondingly absorbed. The intra-abdominal pressure is lowered, and there is a tendency to a gradual, atonic dilatation of the hollow viscera in establishing an equilibrium. Digestion is disturbed, bowel action becomes torpid, and all of the secretions are below par. The patient often develops into that low state of health ordinarily referred to as "asthenic," and in extreme cases, has even been referred to as "neurasthenic." If this poor state of health is permitted to go on for months or years, the abdominal muscles become

weak and flabby and give way under the malnutrition and gas distention as well as the weight of the lowered organs, until finally the entire shape of the abdomen is changed.

Pathology and Manifestations of Ptosis. Just when does ptosis begin to manifest itself in the life of the individual? Richard Smith studied more than 260 frail children under twelve years of age and more than 400 women, and reached the following conclusions: "The enteroptotic habit of adult life finds its counterpart in the frail child presenting the same fundamental characteristics—frailness, lack of fat, slenderness of muscle, lack of vigor in body development. Any actual collapse of the thorax or diminution in the capacity of the upper abdomen, is seen only in older children, and then only exceptionally even in frail subjects. The prolapse of the kidneys, stomach, colon and intestines, which accompanies the enteroptotic habit of adult life is not outspoken in childhood (under twelve years) except in rare instances, and then usually late in that period."

These observations by Smith have been most painstaking and it is quite probable that any multiple of cases so carefully examined will continue to bring the same conclusions. Smith's studies of this number of children, taken with his studies of more than 400 enteroptotic women, constitute a very valuable link in the study of ptosis. But after going over all his work, we find that there is a missing link. He has examined all these women and children and has found that certain conditions exist, and that this habitus develops after twelve years of age, but he fails to tell us why it develops at that time. It seems that Goldthwait's studies along the same line have supplied the missing link. Goldthwait thought for some time that this characteristic condition, known as the enteroptotic habit, was due to faulty posture in early life. As his observations became more extensive he noted that his theories would not entirely account for these cases, and as his knowledge of the subject developed he reached the definite conclusion that there must be congenital

defects in most cases. After making anatomical and embryological studies along the lines which have preceded in this paper, he states:

"In this development, the colon, which originally has a free mesentery, becomes adherent to the posterior abdominal wall in the ascending and descending portions, and to the omentum and indirectly to the stomach in the transverse portion. At the time of birth, the development should have reached this stage, but apparently in a considerable number of cases birth takes place before this development is complete. The child is born too soon from an embryological point of view, and begins life with a movable colon, and consequently with less natural support for the stomach. The obvious result of this is that as long as the child is an infant and its activities and habits are largely those of the quadruped, very little disturbance occurs, but when the erect posture is assumed, the disadvantages of such formation are evident."

The child, after this stage of development takes place, in extreme cases, gradually develops and assumes a permanent attitude, which Goldthwait describes as follows: "Drooping shoulder, prominent scapulæ, the spine inclining upward and backward from the lumbar region with very little curve, being almost straight until the upper dorsal spine is reached, when it bends sharply forward. With this the abdomen is much larger in proportion than the rest of the body, the lower portion being the most prominent, while on palpation and percussion the parts are soft and tympanitic."

In discussing the pericolic membranes in these ptosis patients, M. L. Harris states that the development of such membranes takes place between twenty and thirty-five years of age. This corresponds exactly to my own experience, in which numbers of these patients have been operated upon for appendicitis about the age of twenty or twenty-five, when it was found that the appendix was not diseased but that a definite active edematous membrane was develop-

ing over the ascending colon. I have noted that this membrane, both in its stage of development and in later stages, which Jackson and Long have described, runs diagonally from the right lateral parietal peritoneum across the ascending colon, then extending around it to its mesentery. An interesting thing has been observed by us, which is that this membrane only develops in cases of mobile cecum, in which the cecum occupies the pelvis. The membrane seems to develop exactly at the point where the mobile colon crosses the psoas muscle, and, therefore, one influence in the formation of this membrane might be the pressure on the cecum between abdominal wall and the psoas muscle, for the two are very close at this point.

The typical patient described by Goldthwait, Smith and others, present a very characteristic picture. The rational theory as to the production of this seems to be as follows:

First, there is a defective fixation of the normally fixed parts of the intestinal canal. As soon as a child reaches maturity the organs gradually tend downward. The cecum, transverse colon, intestines and kidneys gradually pass over the psoas muscle into the pelvic region. This leaves a vacant space in the upper part of the abdomen. The ribs, both because of this vacant space and because the organs are tugging on the diaphragm and thoracic fascia, are drawn slanting downward until the typical corset-shaped chest is produced. The upper part of the abdomen becomes permanently narrowed. The ribs become fixed in this position. The lower abdomen becomes permanently dilated. The stomach and other organs being below the waistline, have piled up. Tone has diminished. The organs have become permanently dilated and the patient presents the typical pot-bellied appearance, with the lumbar and dorsal vertebræ being straight, according to Goldthwait, up to the upper portion of the dorsal region, where a sudden bend forward makes a definite stoop in ptosis patients. This, according to Goldthwait, is due to traction on the diaphragm and thoracic

fascia. This dragging on the chest diminishes its capacity, and thereby cramps the heart and lungs, makes distress in the chest. The upper abdominal capacity being lessened the organs tend to slide off the shelf. The tendency then is for the lower part of the body to get in under the load which is falling off its shelf, producing much the same position of the body as one assumes in carrying a heavy load in the arms on the abdomen. We have, therefore, termed this the "carrying position."

The stomach, cecum and other hollow organs dilate, due (*a*) to disturbance of relation of the movable portion of the alimentary tract to the fixed portions, and (*b*) reduction of intra-abdominal pressure by absorption of fat. This dilatation of the stomach and intestines causes a thinning out of these organs, they constantly being filled with gas, thus stretching the normally fixed supports. If such a stomach is examined by roentgen-ray the peristaltic wave is found diminished or in some instances almost absent.

It is very interesting to watch such a patient after fattening by forced feeding, thereby increasing the intra-abdominal pressure. The stomach which is down in the bottom of the abdomen, dilated and without peristaltic waves, will often rise to a point above the umbilicus, diminish its lumen to less than one-half and develop normal peristaltic wave.

It has been the custom of many learned physicians to dismiss the ptosis question by saying it is a general process in which we find the stomach, liver, kidneys and all abdominal organs down. As a matter of fact in many of the most troublesome cases of ptosis the kidneys are not down with the other organs.

Longyear has given us probably the best treatise on floating kidney. He has called attention to what he has termed the nephrocolic ligament which attaches the kidney to the colon. He has called attention to the fact that it is the colon which drags the kidney out of position. This would explain why we have a right floating kidney much more frequently

than the left. The right colon and hepatic flexure is much more likely to be movable and out of position than the left colon and splenic flexure, partially because the splenic flexure is held by the splenic colic ligament and costocolic ligament, in addition to its normal fusion to the parietal peritoneum. The most distressing forms of ptosis we have noted are not accompanied with floating kidney. It is rather uncommon to have floating kidney in a case in which the ascending colon and hepatic flexure have a long mesentery and are not attached at all. This adds much weight to Longyear's contention that the kidney is pulled out of position by the hanging colon through the medium of what he calls the nephrocolic ligament. Where the ascending colon and descending colon have fused properly with the lateral parietal peritoneum such a thing as a floating kidney cannot exist no matter how thin or how wasted the patient becomes. It seems that the floating kidney exists particularly when the colon has moved over and become attached to the front surface of the kidney instead of only the lateral parietal peritoneum. It there adheres to the parietal peritoneum in front of the kidney, but the peritoneum of the ascending colon and cecum do not attach to the parietal peritoneum. So, we have in cases of potential floating kidney, the hepatic flexure of the colon attached to the front surface of the kidney with a mobile cecum and ascending colon. It is probable that these fused peritoneal layers in front of the kidney form the nephrocolic ligament of Longyear.

The Relation of Right-sided Ptosis to Diagnosis of Right-sided Pathology. The relation of right-sided ptosis to the diagnosis of right-sided pathology is one of the most interesting phases of abdominal pathology. If we take hospital reports of fifteen or twenty years ago we find that there were about 4 cases of chronic appendicitis in the records to one of acute appendicitis. This is changing. One of the most instructive articles which has been written on this subject was that of Chas. L. Gibson, in the American

Journal of the Medical Sciences, May, 1920. In his service at the New York Hospital he reported 555 cases of chronic appendicitis from January 1, 1913, to July 1, 1919, six and one-half years. During the same time he operated upon 820 patients for acute appendicitis. More than 30 per cent. more cases of acute than of chronic appendicitis. Moreover, a number of his chronic appendicitis cases showed no evidence of disease of the appendix on macroscopic examination.

In many of my surgical cases in the past I have removed what appeared to be normal appendices, at the request of the patients. No symptoms had ever been noted by the patients. Pathologists reported about 50 per cent. of these appendices diseased in some degree. This is in about the same proportion that we find definitely diseased appendices, where a diagnosis of chronic appendicitis has been made. My associate, Dr. Sears, several years ago, went over several hundred of our records and found that of the patients presenting themselves for abdominal symptoms, who had had appendices removed elsewhere for chronic appendicitis, 70 per cent. had not been relieved in the least by the operation. In other words appendicitis was not the correct diagnosis. In many of these cases operated upon for chronic appendicitis but in which we found at operation no evidence of disease of the appendix, we have found pericolic bands or adhesion of the appendix to the posterior parietal peritoneum, causing the appendix to be the ligament and chief support of the ascending colon and cecum. In the majority of these cases in which the pericolic bands exist the patient will not be relieved by removal of the appendix for the reason that it is not the diseased organ. In such cases, usually the band or membrane will be found to be supporting the colon at some given point, while the rest of the colon is movable. In other words in the mobile cecum, the appendix as pictured by Lane, has attached to hold up the colon and correct the malposition.

It is the habit of many very good surgeons today to make

a diagnosis of gall-bladder disease, saying that "there may be no gall-stones and there may be no visible evidence of septic infection, but it is a gall-bladder case." At most of the clinics of the country we find such gall-bladders being exposed. Occasionally they are drained. Many are removed. I am confident that many perfectly healthy gall-bladders are being drained or removed when the gall-bladders are by no means at fault. In such a case it will usually be found that an acquired band runs along beside the gall-bladder and from its tip to the omentum and colon. In other words, the gall-bladder is supporting the colon the drag of which is causing the pain in the gall-bladder. The removal of the gall-bladder will in many instances relieve the traction and relieve the pain. However, if the gall-bladder is not diseased and the pain and symptoms are due simply to traction of it by the acquired membrane, it seems very poor surgery to remove or drain the gall-bladder; for in our experience such cases are even better relieved by simply shortening up the supports of the ascending colon and attaching the omentum of the transverse colon to the abdominal wall.

Many cases of so-called duodenal ulcer, in the past, have been operated upon without the presence of ulcer. Patients were not benefited by gastro-enterostomy, but rather were made worse. After a while bad results caused operators to desist from such operations. Then it was found that bands and membranes had grown across the duodenum at a point corresponding to the pain and to the obstruction. Some began to remove these bands and membranes. In a few instances this gave relief, but generally of course, the bands came back. If such a case is examined carefully it will be found that the membrane crosses the first or second portion of the duodenum, grows down into the gastrocolic omentum, forming a strong band or membrane which seems to be the sole support of a perfectly movable colon. The interesting part of such cases is that the removal of these bands usually is not followed by success. The drainage of the gall-bladder

or gastro-enterostomy, which have been done in some instances, is bad surgery.

Midline Ptosis. As far as I know, I was the first to use the term midline ptosis as being more comprehensive than the simple term gastroptosis, inasmuch as the transverse colon usually precedes the stomach downward and is therefore a part of the process. In midline ptosis the first and second portions of the duodenum are firmly supported by the gastrohepatic omentum. In fact, the duodenum is often fixed in an unusually high position. The cardiac end of the stomach is fixed by the esophagus and certain peritoneal supports. The flexures of the colon are usually fixed normally. The middle or pyloric portion of the stomach and the middle of the transverse colon descend, forming a V between these fixed points of the stomach, on the one hand, and the flexures of the colon on the other.

Midline ptosis is an acquired condition and is usually found in persons who stand a great deal, and who often overfeed or drink large quantities of water, or who carry loads in the arms on the stomach, or who take severe exercise, such as rough horseback riding with a full stomach.

All of my first cases, including the very first, were of the midline ptosis type and presented very severe symptoms, which justified surgical interference. Midline ptosis often gives very severe symptoms. If the omentum becomes adherent to the pelvic organs or to a postoperative incision the ptosis is made permanent.

Treatment. If our conception of the subject of ptosis as set forth in the foregoing pages is correct, then treatment must be applied for the definite purpose of remedying a condition in the individual case. We must recognize that there is such a thing as midline ptosis entirely independent of the subject of general ptosis—that general ptosis is possible only in cases of defective fixation of the normally fixed portions of the gastro-intestinal tract.

The skeletal changes noted by practically all authors

dealing with this subject are probably secondary to the peritoneal defects. These skeletal changes, having remained long enough, become permanent and such a patient cannot by any means always be made a perfectly normal individual. The asthenic or defective nourishment feature of the ptosis patient is probably brought about by stasis and digestive disturbances produced by angulations and by loss of fat, which reduce the intra-abdominal pressure, thereby permitting the intra-visceral pressure to dilate the stomach and intestines, and even the bloodvessls and ducts. The walls of these viscera, by this constant stretching, become atonic.

With these principles in view our treatment would be as follows:

1. *Prophylactic.* (*a*) Every child reaching puberty, on showing symptoms of the frail child as described above by Richard Smith and even more clearly by Goldthwait, should be placed in the very best of health; (*b*) should be fed the most nutritious and fattening diet, (*c*) should be taught exercises and postures for making a perfect frame, as is taught by Goldthwait; (*d*) and should be taught in every possible way that would be conducive to health and structural perfection. It is probable that a majority of so-called physical defectives or potential ptosis patients can at this stage be so directed as to make fairly healthy individuals all through life.

2. *Medical and Orthopedic Treatment.* The majority of adult patients, most of whom are women, coming under the head of general abdominal ptosis, are miserable individuals, with all kinds of vague discomforts over the body, but particularly in the abdomen, without any local manifestations which stand out sufficiently to definitely localize pathology. These patients are very uncomfortable and usually make their friends and relatives uncomfortable and prove to be baffling for the physician or surgeon. They have in the past often been dismissed by many of our ablest physicians and surgeons as neurasthenics or "neuros." Such cases are

definitely medical cases, as a rule. By medical we mean non-surgical, for very little or no medicine is to be used. We are dealing with a physical and mechanical condition at some stage of advancement. As a rule we are dealing with one who has defective fixations of the gastro-intestinal tract; usually has deficient intra-abdominal pressure, which is followed by dilatation and atony of the visceral musculature; often thinning and stretching of the abdominal wall, and frequently narrowing of the upper abdomen. Our problem, then, is to correct these conditions.

All treatment should be preceded by a very thorough examination of the entire body, including gastro-intestinal *x*-ray. The first step in the treatment consists in increasing intra-abdominal pressure. This is done by forced feeding, which was popularized if not originated by the late Weir Mitchell, whose conception of these cases was that it was a a nerve condition and that the nerves should be padded with fat to prevent irritation. Such patients, with the proper application of heat and regulation of diet, can be made to gain very rapidly if kept in bed. There is usually a period of toxemia about the second week in which the patient becomes very miserable. It often takes a great deal of persuasion and driving on the part of those in charge of the case to force the patient to continue the increase of diet during this uncomfortable toxic period. For this reason such patients are rarely treated successfully in the home without a specially trained nurse. Therefore, these patients become hospital cases at once, for the average trained nurse who is accustomed to granting every desire of the patient usually fails in the treatment of these cases. In our institutions where we treat these cases we never permit the patient to have a special nurse.

It is not the purpose of this paper to go into the details or technic of treatment, but a very important feature in this connection is the use of the hot pack over the stomach after meals. As the patient increases in fat, being in a re-

cumbent position, the organs gradually tend toward the diaphragm. The increasing presence of fat in the abdominal cavity, enclosed by an inelastic wall, gradually increases the intra-abdominal pressure, thereby counteracting the intra-visceral pressure and increasing the thickness and tone of the visceral wall. In many of these cases we have by repeated *x*-ray examinations found that the stomach has gone upward several inches and its peristaltic wave restored to normal, and the stomach and bowels have assumed their normal activity.

Inasmuch as many of these patients have skeletal changes with narrowed upper abdomen and dilated lower abdomens, it is necessary to go further than simply the forced feeding and increasing the intra-abdominal pressure. After a certain amount of fat has been accumulated exercises are used for the development of the abdominal wall; postural, orthopedic and athletic methods are used for the expansion of the upper abdomen, and, above all, the patient must be trained as to the importance of system and regularity as well as self-control. This treatment usually requires two to six weeks in the hospital and a year or two of constant vigilance after the patient has left the hospital. Many of these patients are not perfectly well, but the majority live and follow their occupation quite comfortably. Many of them are definitely restored to normal health. The far-advanced cases with marked skeletal changes, of course, never become rugged individuals and many of them are still invalids.

The majority of cases of midline ptosis without fixation of the omentum to some point lower down and without obstructive symptoms may be relieved by the forced-feeding treatment. A certain proportion, however, have the omentum fixed lower down in the abdomen, either to a hernia, to the pelvic organs or some operative field or wound, or have definite obstructive symptoms. These cases should be classed as surgical.

3. *Surgical Treatment.* Indications for surgery in ptosis patients:

(*a*) Definitely localized pain.

(*b*) Obstructive symptoms.

(*c*) Ptosis made permanent by inflammatory adhesions.

As before stated, midline ptosis, or gastroptosis, was at first the sole occasion for surgical operation for prolapsed organs. Duret sutured the lesser omentum to the abdominal wall. Rovsing sutured the anterior surface of the stomach to the abdominal wall. Beyea shortened the gastrohepatic omentum. In 1901 I sutured the great omentum both above and below the colon to the anterior abdominal wall, producing what was termed the "hammock operation." Pilcher later added a feature to the hammock operation by passing the suture through the gastrocolic omentum through the transverse mesocolon. This, in certain cases, is a very valuable addition to the original technic for doing the hammock operation.

Right-sided ptosis, which has been long recognized as a very common condition, manifesting itself to everyone as a right floating kidney, constitutes one of the difficult problems of surgery in connection with the ptosis question. Longyear called attention to the movable colon, which he found attached to the front of the movable kidney by what he termed the nephrocolic ligament. He therefore exposed the kidney and attached the connective tissue fibers below the kidney and back of the colon to the muscles and aponeurosis of the back, claiming to cure the symptoms in the ptosis patient, including correction of constipation, for by this operation he fastened both the kidney and colon; Wilms placed the ascending colon back of the peritoneum; Klose sutured it to the lateral parietal peritoneum; all claiming very good results. Waugh, of London, has recently reported two hundred surgically treated cases in the *British Surgical Journal,* with good results.

However, the broader view of the subject must be considered. Glenard, and Lane more particularly, have called atten-

tion to the frequency of bands attaching to and sometimes partially surrounding the cecum and ascending colon, which are often very painful. Morris and others have called attention to adhesions in the upper abdomen, which Morris has called "cobwebs in the attic of the abdomen.'' These bands along the right side of the abdomen are painful and produce symptoms of organic disease, and very frequently healthy organs are removed or drained when, as a matter of fact, the pain is due to acquired bands, which Lane and others have shown, and which bands have developed for the purpose of holding up the organs in cases of defective fixation. Therefore, when we open the abdomen for a painful condition and fail to find a definite organic disease, but do find defective fixation of the colon and duodenum accompanied by acquired bands, such as have been described by Lane and J. W. Long, and later by Jackson as a veil, it seems that our duty as surgeons is plain, namely, we must remedy the defect surgically, as far as possible, which has caused the trouble.

Often it is found that the appendix is the sole support of the ascending colon, which has attached itself to the parietal peritoneum, forming a ligament. The appendix is sometimes removed in these cases, although it does not often relieve the symptoms. In nearly all of these cases the symptoms have been attributed to an organic lesion. They usually become evident in early adult life. The treatment is appendectomy, shortening of the supports of the colon and fastening its mesentery to the lateral and posterior parietal with interrupted purse-string, chromic catgut suture, taking care under no circumstances to include in the sutures the intestinal wall proper. The sutures are then continued around the point where the hepatic flexure should be, coming forward to the lateral parietal peritoneum and anterior abdominal wall, using the mesentery until the edge of the omentum is reached. The suture line is then continued, picking up the omentum above and below the colon and suturing it to the anterior abdominal wall over to the median

line, and at times even two or three inches to the left of the median line, in order to support the transverse colon and prevent a dragging on the pyloric end of the stomach, duodenum and gall-bladder.

Most cases of painful right side in which no disease of the gall-bladder, duodenum or appendix is apparent, and in which definite bands may be discovered either in the neighborhood of the gall-bladder, duodenum and ascending colon, which are for the evident purpose of helping to hold up the colon to its normal position, are relieved by this operation much more satisfactorily than by removal or draining of the gall-bladder or by the removal of the appendix alone.

Whereas in the past the great majority of these patients were not cured by simple removal of one of these organs, we are now able to relieve this condition in practically all cases by the procedure just described. This is particularly true in the young adults who usually come to be operated on for appendicitis.

Finally, what are we going to do with the extreme cases of general ptosis in which both kidneys and all the organs are down in the lower part of the abdomen and the patient is a misshapen invalid not relieved by medical treatment of any kind? In such cases, less than a dozen in all, we have anchored both kidneys and made a complete partition across the abdomen by suturing the omentum and mesentery to the abdominal wall. In some cases we have expanded the upper abdomen and contracted the lower abdomen by plastic operation, which we have described elsewhere. These cases have been very satisfactory, although the operation is so extensive and long-drawn-out that we only felt justified in doing it in a very few cases.

In conclusion I will say that in the experience of more than eighteen years in which the subject has been extensively studied, and in which many hundreds have been treated either medically or surgically, I am convinced that there is not a field of medicine today which demands more of the

earnest attention of the profession than this. There is no class of patients to whom the physician and surgeon can apply more helpful and valuable treatment than in these cases. But be it remembered that the subject is not one in which the man who is so superficial as to consider the position of the stomach and intestines as the principal feature of the case, or, on the other hand, who is so inscrutably scientific and spiritual as to classify the subject under psychology, is prepared to treat these cases. It is a plain physical and mechanical problem requiring the serious consideration of a real student of medicine, and when more men of this type devote their attention to the subject it will probably be considered one of the most important if not the most important field with which physicians have had to deal.

DISCUSSION

Dr. Charles L. Bonifield, Cincinnati, Ohio.—I have been exceedingly interested in Dr. Coffey's paper, particularly with the broad view he takes in regard to the etiology of these cases. We have recognized for years that in a patient whose kidney is slightly mobile, by having her take on fat, we can practically cure her, symptomatically at least. I have personally thought for a long time that the ptosis of many of these organs was due to a lack of fat in the mesentery. My attention was first called to that by personal experience, which I think may interest Dr. Coffey.

When I began to practice medicine I was a very thin individual with incipient tuberculosis, and one night in lifting a heavy patient I developed a right inguinal hernia. In a few months I had a left inguinal hernia and wore a truss for years. My health improved. I took more outdoor exercise and gained 30 pounds in weight and the two hernias absolutely disappeared. Afterward I contracted pneumonia and was laid up for a considerable part of the winter. I coughed a great deal and got up with my two inguinal hernias again. In due time I got my weight up to 190 pounds and they disappeared. This was

over twenty years ago, and the hernias have not appeared since I took on that fat. Putting fat in the hernial ring would have no effect, but putting it in the mesentery lifts the bowel up and prevents its protrusion.

I think there is a great deal in what Dr. Coffey says about this. Unfortunately in the treatment of some of these cases it is undoubtedly like treating the condition we spoke of this morning—retroflexion of the uterus. If we put the uterus in place and keep it there long enough to enable the patient to regain her health and the uterus to regain its tone we will not have to operate on her.

Many of the operations we do for retroflexion of the uterus will not hold it permanently if involution does not take place. But involution occurring the result is permanent. Oftentimes it is impossible to secure involution without some operation that at least temporarily holds the uterus in place. I think this is true of many cases of ptosis. If the structures can be held in their normal positions for a time a symptomatic cure will occur.

When the condition has existed for many years, as in the patient whose picture Dr. Coffey exhibited, where the abdomen is large and the patient much emaciated, the colon has not only become atrophied in its muscular coat but it becomes so tremendously elongated that I do not believe any operative measure will ever cause it to return to its original size and shape. In my experience these colons are not dilated much, but they are tremendously elongated, and the wall of the colon is very thin. In the first patient on whom I did a short-circuiting operation, I had no intention of doing it when I opened the abdomen, but when I lifted her transverse colon out I found that it would hang down below the vulva if I permitted it to do so, and I did not see how I would get rid of it, and so I did the operation preparatory to removal. This was an extreme case. I think with Dr. Coffey if we can get these desperate cases early 90 per cent. of them can be cured, but every once in a while we will get one of these neglected cases where we must do surgery, and scarcely any surgery is too severe if it results in a permanent cure.

Dr. James E. Thompson, Galveston, Texas.—I am sorry that Dr. Coffey is not present, because it is somewhat unfair to attack a man unless he has a chance to answer for himself. I differ with him radically. In the first place it is impossible

to grant his premises. If one grants premises one can almost prove that black is white. It is an axiom in logic that one cannot disprove a fallacy completely unless one is able to show the manner in which the fallacy crept in. Dr. Coffey laid much stress on the presence of fat in the retroperitoneal space as a supportive agent. This is undoubtedly true. Not alone does it support the viscera, but the deposition of fat is the index of a tendency toward general well-being and goes hand in hand with strong muscular tone. His statement that we never get ptosis of the kidney without failure of rotation of the colon will not bear criticism. Presuming that he means failure of rotation of the cecum and part of the transverse colon I am in a position to prove from repeated observations in the dissecting room that ptosis of the kidney into the right iliac fossa is frequently met without this anomaly being present.

As regards the significance of Jackson's veils I understood Dr. Coffey to state that these structures were produced by traction of the bowel in its descent. Does it not on the face of it seem a foolish thing to attribute strong cicatricial tissue, such as these veils are composed of, to such a condition as this? They are present in young babies and young adults, under normal conditions, and can be seen at any time in any dissecting room. It is more than probable that these veils are the result of natural processes of adhesion in the course of rotation of the colon. In other words, they are the remains of an adhesive fetal peritonitis which fixes the colon after it has undergone rotation. Under ordinary conditions, given a good, healthy abdominal wall and healthy tone of the muscle of the bowel, these veils will never give rise to symptoms. If, however, muscular tone is lost and ptosis occurs, kinking of the bowel will occur at the site of each veil and the bowel will hang pendulously between the points of its firm attachment. I admire Dr. Coffey's enthusiasm immensely. I do not, however, think that enthusiasm will help him out in an argument that is based on wrong premises. A house built on sand is unstable.

Dr. Robert C. Coffey, Portland, Oregon.—The above paper was delivered extemporaneously with the aid of lantern slides. It is evident from Dr. Thompson's remarks that I did not succeed in making my position clear. Reading the full text will clear these points of criticism.

PRELIMINARY LIGATION OF THE COMMON ILIAC ARTERY IN HIP-JOINT EXARTICULATION

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One cannot seriously contemplate exarticulation of the hip without developing an acute interest in the experience of those who have preceded him. When it is to be combined with a preliminary ligation of the common iliac one's interest is naturally increased. There have been too few of the double operations successfully completed to have clearly paved the way for its routine application, and that more light may be shed on the procedure, a brief reference to the valiant and instructive efforts of these pioneers may lend interest to the study.

Now and then, there appears in the medical firmament, a man with an idea endowed with the persistence necessary to enforce its development and recognition. Such a man was Morand. In 1729, fifty years before the idea was put into actual practice, before the Royal Academy of Surgery of Paris, he represented amputation through the hip-joint as not only possible but practical. As is usual, when departure from the beaten path of experience and empiricism is advised, the promoter is condemned as a radical and he is shamed into silence; but not so with Morand. After a decade of waiting, through the medium of two of his followers a thesis was presented to the Academy, describing in detail the operative procedure and reiterating his belief in its justice and practicability. It was promptly and unanimously rejected. In 1756, he succeeded in having the subject discussed in a prize

essay and twelve responded, all of which met the same fate at the hands of the men of science. Finally, three years later with admirable faith in his convictions, he was again able to secure the presentation of the subject in a prize essay. Of 34 contestants, 19 favored the procedure, and a defender of the operation, Barbett was awarded the prize. Morand died before an amputation was attempted, yet one must assume that his satisfaction in the acknowledgment of the possibility of his radical suggestion, brought well deserved solace to his final days.

Kerr of Southampton, records the first completed attempt at hip amputation in 1774, and although he inadvisedly performed it on a tuberculous hip, the fact that the patient lived fifteen days clearly refuted the contention that immediate death would follow, and lent courage to those who had occasion to attempt it later. During the Napoleonic period it was applied in military surgery and at least two survivals are recorded, at the hands of Larrey, the Emperor's noted Surgeon. Since that time, with the gradual improvement in surgical technic, antisepsis and asepsis and a clearer knowledge of the indications for hip-joint amputation, many successes have resulted in both civil and military practice.

The unusually high mortality following removal of one-fifth the body weight, especially under the unfavorable circumstances that invariably attend the act, should justify this report. In so far as our information serves us, but few previous reports have been made of premeditated permanent transperitoneal ligation of the common iliac as a preliminary step to exarticulation at the hip joint. One of these cases was ably attended by Barney Brooks, of St. Louis, and will be referred to later. Halsted's admirable "Review and Report Upon the Effect of Ligation of the Common Iliac Artery on the Circulation and Function of the Lower Extremities" furnishes convincing proof of the ability of the collateral circulation to continue the necessary blood supply to the limb. Thus is removed any uncertainty as to subsequent

viability of the stump in hip disarticulation, provided the anastomatic circle is not broken by disease of the blood-vessels themselves. It is obvious that in so brief a discussion all reference to the etiology and pathology of the conditions necessitating this operation must be omitted.

In reviewing the opinions of various authors as to the actual cause of the high mortality, loss of blood stands paramount. One does not ignore the fact that in the majority of instances where the operation is indicated the resistance of the patient has been broken and his vitality undermined by long continued disease, or has been weakened by severe trauma, hemorrhage or sepsis. It would, therefore, seem incumbent upon us in our search for an effective check to the high per cent. of fatalities to directly attack the causes that contribute so generously. In the order of their importance these factors are hemorrhage, shock and sepsis. Shock is so closely related to hemorrhage that a concise definition is impossible. Its prevention, control and relief are so dependent upon the preoperative precautions, operative technic and postoperative care, that further discussion here would seem ill advised. Sepsis, since a knowledge of its prevention has become general, has been the accepted cause of death in so small a number of cases that it may be dismissed as an unimportant factor. When death follows so formidable a procedure from shock, hemorrhage, or both combined, it occurs before serious infection has time to make itself known, even though it were present to an alarming degree.

There are but rare occasions when hip-joint disarticulation is so immediately imperative that primary blood loss and shock from the original trauma cannot be eliminated before operation. The blood picture may be improved and the stability of the patient reëstablished until sufficiently fortified to withstand an ordinary amount of shock and hemorrhage and the operation can proceed by any ordinary method with a fair assurance of success. Under such condition any of the various forms of tourniquet control that can be applied and

held sufficiently high to give ready access to the hip-joint structure should be acceptable. Prevention of tourniquet displacement was cleverly accomplished by Trendelenburg with the aid of one transfixion pin; Wyeth greatly improved the method by the use of two transfixion pins; Deaver and others with retraction bandages over the opposite shoulder or supported by an assistant. Senn exposed the femur by a lateral long-axis incision and by blunt dissection, posterior to the adductor group, insinuated a double elastic, thus constricted the two halves separately, leaving the femur free for removal. Each of these and other similar methods prevents free access to the pelvic girdle attachment of the muscles of the thigh that as a future source of danger, it may be desirable to totally resect. In obese patients the deep vessels are controlled with difficulty and the general oozing, seemingly insignificant, may possess the balance of power when the margin of safety is slender, and should not be considered negligible. Wyeth after ligating the femoral, obturator, sciatic, external and internal circumflex, very properly remarks: "If every oozing point were ligated, from one-half hour to an hour would be consumed in securing a dry wound in the majority of cases." This oozing he controls by quilting the muscles of the stump. He reports 69 cases operated by his method with a mortality of 15.9, a most flattering decrease from the day of Walter Brashear, whose hip disarticulation in 1806 is the first on record in this country. As described by Prof. D. Y. Yandell in "American Practitioner and News 1890," Brashear "made a circular incision, divided the muscles well below the hip-joint securing the vessels as the operation progressed. A longitudinal incision along the outer side of the limb exposed the remainder of the bone, which being freed from its muscular attachments was disarticulated at the socket." This is evidence of how little our technic has improved in the last century, as well as a tribute to the intrepidity of the Kentuckian. In 1881 Prof. John Ashhurst, Jr., wrote; "A removal of the lower limb at

the coxofemoral articulation may be properly regarded as the gravest operation that the surgeon is ever called upon to perform, and it is only within a comparatively recent period that it has been accepted as a justifiable procedure. The most pressing risk is that of hemorrhage."

Circular No. 7, War Department, S. G. O. 1867, publishes a most impressive report on "Amputations at the Hip-joint in Military Surgery," presented by Lt. Col. Geo. A. Otis, at the request of Surgeon General Barnes; 53 instances of hip joint amputation are rehearsed in detail. He reviews in most interesting fashion the history of hip joint exarticulation down to his period. He cites 108 amputations, for gunshot injuries up to the time of the Civil War, of which 10 recovered, a mortality of 91.6; 111 hip joint amputations in civil practice with 46 recoveries a mortality of 58.5. Otis ascribes the cause of death to "shock to the system, secondarily to hemorrhage, primary and secondary, and to sepsis. The external iliac was easily controlled in most instances, the greater danger coming from the branches of the internal iliac. Consequently aortic pressure of many types were tried from the illogical 24 inch intrarectal wooden compressor of Davey, to digital or fist compression of the femoral and aorta. Secondary hemorrhage was not uncommon, and persistent stump bleeding was the cause of death in several instances.

Preliminary Ligation of the Common Iliac.—The struggle to swing the formidable operation of hip-joint exarticulation toward the safety column has met only with the measure of success one might rightfully expect from improved asepsis and surgical finesse. The death rate is still too high and the control of hemorrhage and consequent diminution of shock, by means that most assuredly do not increase the danger, is a logical aspiration. In the opinion of the writer, preliminary ligation of the common iliac increases to a justifiable degree the element of safety in those cases wherein further loss of blood and augmented shock cannot be tolerated. Such complete control of stump hemorrhage is thus obtained

that the application of six to ten hemostats is sufficient to assure a dry field. The muscle planes can be gently approximated with negative tension without fear of oozing, or of threatening the viability of the stump. Considering the ease with which common iliac ligation is accomplished and the added safety promised, one cannot refrain from wondering why we have hesitated for so long to carry out in detail the principle which even though crudely has been attempted in practice for so many years by such worthy surgeons as Esmarch, Mott, Lister and other pioneers with the aid of various abdominal tourniquets in an attempt to compress the abdominal vessels and thereby diminish the strength of the current to the affected area. Temporary direct pressure of the common iliac in the treatment of aneurysm of the pelvis and upper limb has been practised for many years with varying success. Some of the experiences are so interesting that it is regretted they cannot be recited in detail. Valentine Mott in 1827 deliberately tied a common iliac artery in an endeavor to cure an iliofemoral aneurysm and was successful in that the patient lived and recovered. Prof. Halsted of Johns Hopkins University, in assembling the recorded cases of ligation of the common iliac artery, which have been reported since 1880, was a pioneer in attempting to prove that the operation is entirely feasible. He estimates an average of one ligation a year for the last one hundred years, the great majority of the efforts being directed toward the cure of aneurysm. Stephen Smith reports all ligations between 1829 and 1859, including one of his own and states that the indications which have led to the deligation of the primitive iliac artery may be divided as follows: (1) For the arrest of hemorrhage; (2) for the cure of aneurysm; (3) for the cure of pulsating tumors which prove to be malignant growths; (4) for the prevention of hemorrhage in the removal of marrow growths.

He concludes even at that early date and in the face of an astounding mortality that "a proper appreciation of the cir-

cumstances under which the primitive iliac artery has been tied for the arrest of hemorrhage will need the discriminating surgeon notwithstanding the excessive mortality that has thus far attended its performance, to accord to this operation an important place among the resources of his art." After many years of effort on the part of various surgeons to control bleeding about the hip girdle by the aid of pressure upon the intra-abdominal vessels, McBurney, assured of the safety of invasion of the peritoneal cavity, practiced direct pressure upon the common iliac through the incision that bears his name, in 3 cases of hip-joint disarticulation with complete success. Since this time his method has been successfully applied by others. If it be true, as stated by Halsted, that gangrene of the extremity does not follow occlusion of the common iliac even without amputation, there can be no well founded objection to permanent ligation of the vessel in preference to temporary compression, wherein control of the blood stream must necessarily be somewhat indefinite.

The case reported by Brooks which was operated by him in July, 1920, as well as the one reported herein by the writer were both extremely unfavorable risks. Both had been subjected to operative trauma and regeneration of malignant activity and presented physical conditions that made the procedures unusually unpromising. In both cases a preliminary ligation was done and both have recovered from the operation. It is true, the number of cases which have received this preliminary step is so few that one has not the right to draw conclusions. It is not with the intention of assuming that unusual significance should be attached to any individual case that the author urges the application of this preliminary step, but for the reason that the principles involved therein are supported by the accumulating experience of all the cases recorded, tending to prove, (1) that ligation of the common iliac is perfectly safe from the standpoint of continued viability of the stump and (2) that hemorrhage is absolutely under control, time is saved and shock materially diminished.

The report of the author's case is briefly as follows: Master J. Kendis, aged thirteen years, entered St. John's Hospital in August, 1920, with a history of indefinite pain and swelling in the right knee, following an attack of tonsillitis. Tonsillectomy was performed and symptoms in the right knee disappeared for a few days. Swelling with terrific pain soon returned. Laboratory test taken at that time reported a three plus Wassermann. Anti-luetic treatment was carried out for several weeks, even though repeated reëxaminations, begun immediately after the positive report, have all been negative. *X*-ray report at the time showed a large area of bone destruction in the epiphysis of the right femur at the knee extending on to the diaphysis at its lower end and mainly confined to the mesial side. No definite proliferation could be made out. Cortex of bone intact. Contiguous surface of the tibia not involved. There was slight increase in the synovial fluid of the knee-joint. The roentgenologist reported it a tumor strongly suggestive of giant cell sarcoma. On October 28, 1920, a specimen of tissue containing bone was removed from the leg, by Dr. A. Horwitz, who referred the case, and a pathological report was returned as follows: "Round cell sarcoma with perithelial arrangement" (Dr. E. L. Opie). On November 2, 1920, Dr. W. Temple, of Kansas City, reported from the same section: "Endotheliomatous tumor belonging to sarcoma group." Dr. Ralph Thompson, Pathologist of St. Louis University, on November 29, 1920, reported the specimen as osteosarcoma. The reaction incident to removal of tissue by Dr. Horwitz was unusually severe. As indicated by the graphic chart, the pulse rate varied from 140 to 160, with a rise of temperature, ranging from 102° to 104°, and unbearable pain in the joint area. Smears from the wound secretion contained mixed bacteria, staphylococci and streptococci. It was determined to reëstablish, in so far as was possible, the resistance of the patient before subjecting him to disarticulation at the hip. The wound was accordingly Dakinized for several days, with

slight improvement in temperature, but no decrease in pulse rate, consequently it was determined to proceed with the operation in the hope that removal of the pathology would be sufficiently beneficial to overbalance the danger of the operation, especially in view of the fact that his general condition was not improving and that metastasis was probably active.

With the encouraging example of the successful case reported by Brooks it was determined to ligate the common iliac as a preliminary step. Under ether anesthesia the operation was performed, with the following technic: Patient is placed in Trendelenburg position immediately following preparation of field of both operations. Incision (for ligation of common iliac) commences one inch above the umbilicus and near the mesial margin of the rectus muscle, which when exposed is retracted outward. A broad peritoneal exposure is thus obtained. Upon admitting air to the peritoneal cavity the intestines fall back and but a light moist gauze compress is needed to maintain excellent exposure of the aortic bifurcation and both common iliacs. The peritoneum over the site selected is elevated, snipped and stretched, the artery by blunt dissection is isolated from the vein and elevated, the loaded ligature carrier directed toward the patient's left is passed under the artery, and the iliac doubly tied and interlocked by heavy braided silk. One hourglass suture suffices to repair the peritoneal rent. The table is brought to a level. The abdomen closed in the usual manner. The entire procedure can be accomplished in a few minutes. Elevation of the affected limb is meanwhile maintained.

For the completion of this report the exarticulation is briefly described: A circular incision at the selected height is made about the limb through skin and fascia, observing a line parallel to the line from pubic spine to iliac crest, that the anal side of the flap may be longer than the lateral. Selecting a point midway between the head of the greater trochanter and the crest of the ilium, a three inch knife is

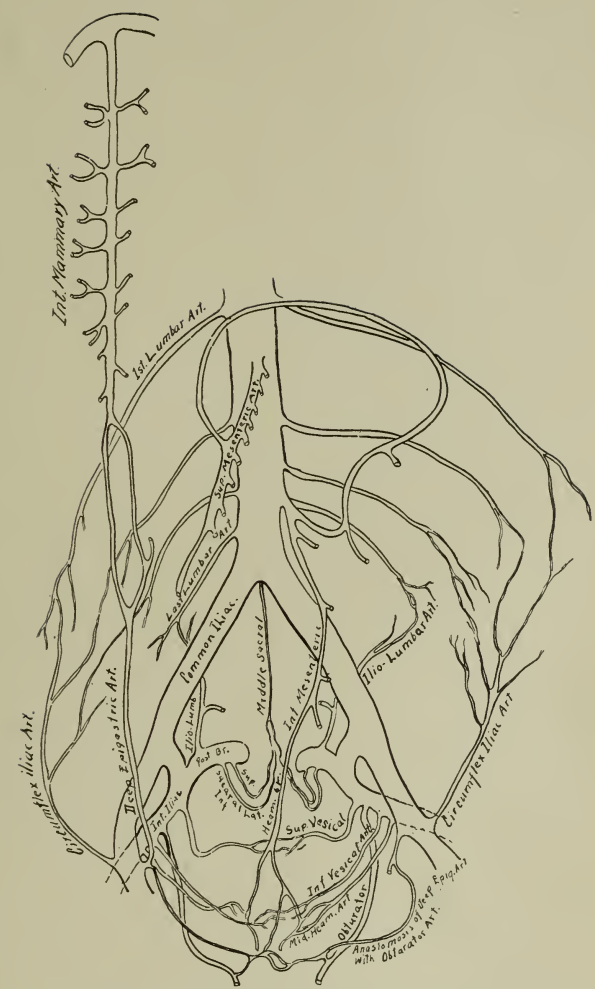

Fig. 1.—Showing collateral circulation.

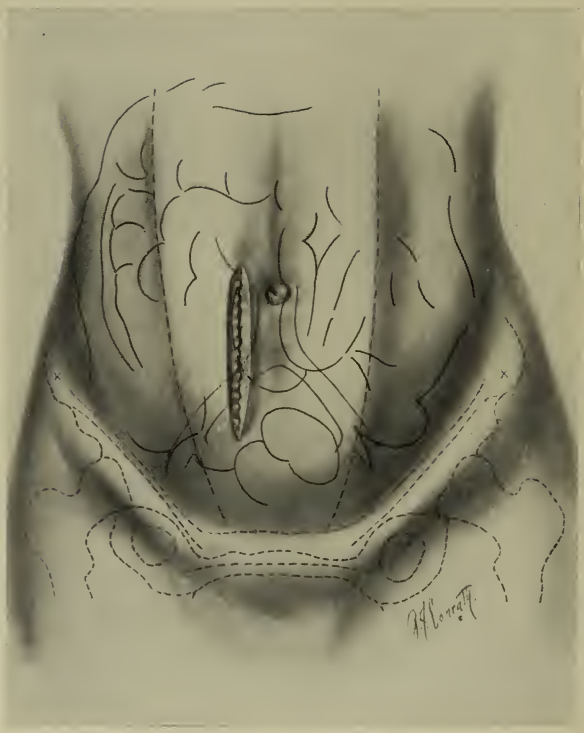

Fig. 2.—Location and relation of ligating incision.

Fig. 3.—Bulging peritoneum between retracted rectus and median lines, a generous time-saving exposure.

Fig. 4.—Patient in head-down position, intestinal loops elevated, pre-iliac peritoneum divided, ureter pushed aside, and ligature-carrier in position.

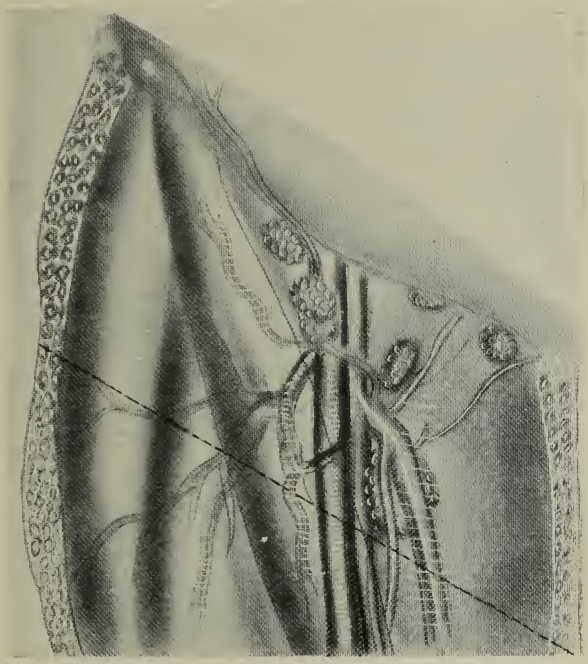

Fig. 5.—Relation of structures at line of skin incision. Inguinal glands and involved muscle groups to be reached through elevation of skin cuff.

Fig. 6.—Exposure and blocking of sciatic nerve. Alcohol injection between cocainized area and line of division.

Fig. 7.—Knife entering capsule at cotyloid margin, from which point it follows bone surface to meet circular incision.

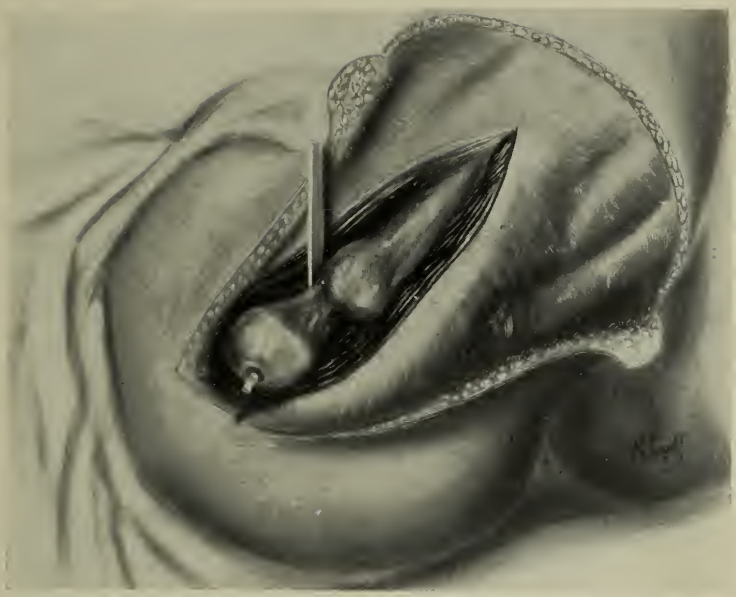

Fig. 8.—Knife has severed round ligament and remains behind delivered head of femur to divide capsular ligament and attached muscles of lesser trochanter and shaft.

thrust home to the head of the femur, entering the capsular ligament at the cotyloid margin. Continuing the pressure the knife is carried down through all tissues to the femur on its lateral surface to join the circular incision below. The limb is elevated, the skin cuffed and the sciatic nerve exposed in its intermuscular bed at a height several inches above the proposed line of muscle section. The nerve is blocked with 1 per cent. novocain; 2 c.c. of alcohol, as suggested by Dean Lewis, is injected immediately distal to the novocain infiltration, and the nerve divided. Acutely adducting the limb, the round ligament is severed and as the head emerges from the longitudinal incision in the capsular ligament the knife remains behind and divides in one stroke the remaining joint ligaments. The muscle groups attached to the greater and lesser trochanters and the shaft may now be divided by a few strokes of the knife, the circular muscular incision at the base of the skin cuff completed and the limb removed. The femoral vessels are compressed by the free hand of the operator during this last circular stroke and immediately occluded with hemostats; as are the gluteal, sciatic, obturator, internal and external circumflex and two or three less significant branches, requiring in all not over eight ligatures to block the termini of the collateral arch. Because of the interest attached to the rapidity with which the collateral circulation asserts itself following deligation of the common iliac, the femoral was momentarily relieved after incising it and a fairly full stream of blood about the strength of the venous current greeted us. The bleeding from the less important vessels, such as the gluteal, sciatic and obturator was of less force, rising to a height of one to two inches, as they were relieved from the compress, for location and ligature. It is interesting to note that no pulsation was observed in any of the vessels that were permitted to bleed momentarily and that the stump, after the few ligatures were applied, remained perfectly dry. Mattressing the stump end was done for cosmetic effect and not for the insecure purpose of con-

trolling oozing. A Dakin tube was directed into the acetabulum and one at the stump end, thus excluding infection and temporarily caring for dead space and serum accumulation.

The after-care of the case presents no feature of interest, not depicted on the graphic chart. A donor was present, and kept available for use should occasion arise. Postoperative shock was never sufficiently alarming that hypodermic or intravenous medication was deemed necessary. The pulse rate continued high as before operation, and while gradually retracing is still above 100 and following each *x*-ray therapy is markedly exacerbated for a time.

As previously stated, conclusions based upon the slender support of a few successful cases would be valueless. Modern surgery has happily reached the stage when conservation is the aim and amputation the exception. Year by year the need for disarticulation at the hip-joint will diminish, but when demanded, will assuredly be less hazardous. The patriarchs of medicine who have had to blaze the trail, upon which we walk with comparative comfort and assurance are deserving of unstinted praise. We are inclined to forget in our selfish enthusiasm the great work that our predecessors have accomplished, that has made our contributions possible and upon which they are founded. The creation of such an impression is far from the desire of the writer.

Attention is directed, in conclusion, to but a few points of interest in this report. Exarticulation at the hip-joint is a hazardous procedure, because of two factors: (1) The injury or disease making the step necessary has already seriously handicapped the patient; (2) hemorrhage, shock and sepsis in the presence of lowered vitality invite disaster. The logical solution, therefore, is (*a*) to refrain, unless forced by emergency, from further trauma until recuperation, compatible with safety, is complete; (*b*) to replenish by blood transfusion the depleted circulation, and reëstablish, as far as possible, the physiological activity of the sufferer; (*c*) to

control hemorrhage and therefore save time and shock by the five minute procedure of preliminary ligation of the common iliac, and, finally, treat operative shock before it develops by preventing all blood loss, nerve and tissue trauma and prolonged anesthesia. It is in the belief that the steps suggested herein are directed toward safety, and are unfriendly to high mortality, that the case is reported.

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LIGATION OF THE EXTERNAL ILIAC ARTERY AND VEIN ABOVE AND BELOW A COMMUNICATING BULLET WOUND OF THESE TWO VESSELS

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Until some one surgeon or a small group of co-workers shall acquire a large clinical experience with recent bullet and stab wounds of the common femoral artery and vein and make reports of the exact findings and method of treatment, to be compared with another group of an equal number of cases treated in a different way; and another group of an equal number treated in still a different way, surgeons will find great difficulty in obtaining concise, easily understandable instructions and a properly standardized course of procedure which gives the highest percentage of cures with the smallest percentage of loss of limb and crippling disability.

Along with his lack of experimental practice in the technic of suturing and tying large arteries and veins, the surgeon when confronted by the management of such an injury, feels also need for clear-cut authoritative information which will enable him to apply good judgment as well as manual dexterity and lead him to pursue exactly the proper course in definite answer to the questions what to do, what not to do and why and when and how, in dealing with these injuries, often among the most dramatic situations in surgery. Disappointment is likely to follow expectation to secure this information from a study of the clinical case reports in literature. The records of laboratory work fail to elicit the

completely assembled practical instruction which one needs at his "finger tips" in formulated plans of procedure. And, finally, when one proceeds to a study of the fundamental principles involved in the gross anatomy, histology, embryology and the highly organized physiology of bloodvessels in the living human being, he might easily become so engrossed by the fascination of the study that it is quite conceivable for him to fail to gain through the penetrating eye of the scientific investigator the broad perspective or bird's eye view of the situation which is so necessary to gain a vision of the whole subject for practical application.

Until through the labor of some combined artist, scientist and philosopher like W. S. Halsted, definite information becomes available, there is justifiable reason in contrast to an unjustifiable excuse for the publication of isolated case reports describing the exact nature of the lesion, the exact method of treatment, subsequent observations and the ultimate results of individual cases.

Pistol bullet and stab wounds are the cause of approximately 80 per cent. of all injuries of large arteries and veins in civil life. There are other causes of these injuries, especially at the roots of the limbs. Fracture in the region of the shoulder and hip;[9] accidental incisions or tears when operating upon such affections as hernia, abscess, bubo, carcinoma; iliac artery rupture following removal of a drainage tube seven days after its insertion at the site of removal of stones from the lower ureter;[21] pressure necrosis of the external iliac artery by forceps placed on the internal iliac artery to control hemorrhage during operation upon these vessels for the relief of enlarged prostate;[17] accidental stab of the vessels in the groin by a child upon flexing the thigh while recovering from an anesthetic for the performance of circumcision[27] (the knife lying on the sheet with its blade directly over the vessels so that it was cut by the flexed thigh); suppuration in the groin and axilla; these and others too numerous to mention have been the cause of injuries to these vessels.

Many surgeons have experienced genuine distress under the burden of anxiety for the first few days following treatment of wounds of large arteries and veins, and many have experienced the thrill of seeing the patient recover without gangrene after suture or ligation of these great vessels. Some have had their initial distress followed by the terrible sensation of seeing the limb become gangrenous during the period of observation; and can we picture the agony which must be experienced by a surgeon at the sight of his patient bleeding to death or, after successful prevention of this catastrophe, of seeing him lose the limb or his life from gangrene, sepsis or secondary hemorrhage following accidental injury to these great vessels while performing an operation for bubo or hernia? These experiences have been the cause of more than one wrecked career and change of occupation.

On the night of August 25, 1920 Dr. W. M. Strickland, responding to a call for the ambulance, found a robust twenty-two year old man with a pistol bullet entrance wound in the left groin just below Poupart's ligament at a position corresponding to the location of the femoral vessels. He immediately plugged the wound entrance with a small strip of gauze, placed over it a pad and, with the man's trousers belt buckled snugly over the pad, hurried him to the Virginia Hospital where I saw the patient within ten or fifteen minutes after his arrival.

Examination showed moderate distention of the superficial veins of the thigh and leg and within an area of ten or twelve inches downward there was distinct pulsation of the veins in this region. The arterial pulse of the foot and leg of the injured extremity were not palpable. On the opposite foot they were easily palpable and normal save for a rate of 110 per minute. Just above the wound examination detected a rather violent systolic thrill and the characteristic aneurysmal bruit. There was a small-sized area apparently of fluid blood beneath the skin in the immediate vicinity of the wound but the wound was distinctly of the dry variety. The man's

general condition was excellent save for the moderately rapid pulse. *X*-ray examination showed the bullet localized posteriorly in the buttock at a level slightly lower than that of entrance and without bone injury. There was no sign of intra-abdominal penetration.

Here then was a case of easily obvious communicating bullet wound of the common femoral artery and vein without external hemorrhage, without hematoma, and in a healthy young man in a properly equipped hospital. The patient was immediately given $\frac{1}{4}$ grain of morphine sulphate and $\frac{1}{150}$ grain of atropine sulphate and within forty-five minutes after his arrival in the hospital, about an hour after being injured, he was in the operating room prepared for operation.

The problems which presented themselves to me were serious and the questions came up in about the following order: Should operation be performed immediately? I was quite aware that many people have received just such a wound and lived without an immediate operation of any kind being performed. I still remember having seen twenty years ago a man with a large-sized traumatic arteriovenous aneurysm involving the iliac vessel caused by a bullet wound received many years previous. He travelled about among medical students to exhibit himself as a means of livelihood. I also remembered that, though living, this man was unable to do hard work and his lower extremity was very greatly increased in size. I also was reminded of the fact that a great many cases of traumatic arteriovenous aneurysm have been operated upon many years after the injury and of Matas' contribution to this Association last year in which he reported numbers of cases of communicating wounds between arteries and veins operated upon at varying periods of from six weeks to fifteen years following the reception of the injury. The case reported by Caldwell before this association several years ago of injury to the subclavian artery operated upon ten days after the injury also came to memory. Certainly with these facts clearly before my mind and with the man

losing no blood externally and also with no hematoma, it would not have been easy for me to have said that he would have died if he had not been operated upon immediately. I felt, however, that operation was necessary upon the basis of prevention of infection, prevention of secondary hemorrhage and the prevention of the crippling effects of arterio-venous aneurysm.

After removing the pad, carefully painting a large area with two coats of full strength tincture of iodine, a clean surgical approach to the iliac vessels well above the site of the injury was easily secured through the standard oblique incision for the extraperitoneal ligation of the iliac vessels. Poupart's ligament was cut, the vessels were exposed and two sutures of twenty day chromacized catgut (number 2 doubled) were placed around the external iliac artery about an inch above the wound well above the deep epigastric and deep circumflex iliac vessels. These sutures were placed about one-half inch apart in position for instant ligation when necessary. With a good exposure, while Dr. Strickland made pressure on the artery with his fingers, I removed the six or eight inch strip of narrow gauze packing which he had previously placed in the wound, and made a longitudinal incision downward encircling the ragged wound of entrance. This was excised and a small collection of blood wiped away. There was some welling upward of venous blood from the depths of the wound while looking for the location of the injury. Working gently and carrying the incision downward slowly the wounds in the artery and vein were found to be large, ragged and communicating. The ligatures above were immediately drawn as tightly as we could make them. It was too late now to suture even though the wound had been a suitable one for this procedure. We had fractured the artery, and crushed its intima. The common femoral artery and vein were then clamped with forceps just above and below the wound and a formal excision of devitalized tissue including the ragged edges of the vessel wounds was made. The vessels

Ligation of the external iliac artery and vein above and below a communicating bullet wound of these two vessels.

above and below the wound were ligated and the surrounding tissue snugly sutured. The wound was dried completely, one or two small superficial veins were tied, a small piece of flat soft rubber was laid in and, but for a small place of exit, the skin wound was closed, dressings applied and the entire limb encircled with cotton from the pelvis to the toes. The patient was placed in bed with hot water bottles beside the limb and an electric light heat under a tent applied to the extremities. The patient's pulse at the end of the operation was 120 and mine was just about the same. I judge we were both in a condition of slight shock though I was not unmindful of the fact that the patient may have had a slight amount of dilatation of the heart. On this account and to facilitate whatever benefit the posture might have on the blood of the limb, we elevated the head of the bed. He was also given a few hypodermic injections of one of the preparations of digitalis.

The next day the patient's general condition was excellent; he said he felt the external heat on his toes and foot and the limb was sweating. The second day he and his leg were still in good condition. After darkening the room, we exposed his toes and held behind them a flashlight. The pink color of the toes and nails under this translucency test gave us great comfort. Capillary response to pressure on the nails was prompt. A week after the operation I took the liberty of sticking a pin in his toe to see if it would bleed. It bled. Ten days after operation the wound was healed, a few days later the bullet was removed from just beneath the skin on the buttock. External heat was kept applied for two weeks following the operation. A few days later he was out of bed and exhibited no evidence of impairment of function of any kind. A month after the operation he was doing light work and anything else he pleased. Two months after operation he was employed in active work as a combined janitor, butler and chauffeur. December 14, 1920, sixteen weeks after the operation, examination fails to detect pulsation of the popliteal or

any arteries of the foot. The region of the wound is hard, no evidence of tumor or pulsation is felt, the superficial veins of the foot are conspicuous but apparently normal. There is no difference in the size of the two extremities, the patient has no subjective symptoms of any kind and notices no difference in the sensations or usefulness of the two extremities. There are no differences in temperature, he walks long distances and up and down steps and uses the clutch of the automobile with ease.

It can scarcely be claimed now that immediate operation within the first few hours is urgently called for to save either life or limb in cases of communicating wounds of large arteries and veins. The large number of cases or arteriovenous aneurysm in literature[20 24 7 12] and the many recorded cases of war wounds successfully transported to distant hospitals,[10 15 4 24 29] successfully controvert this contention. These remarks of course do not have reference to those wounds accidentally inflicted by the operating surgeon and over which he has immediate control. But when an individual is shot or stabbed in these vessels it can scarcely be doubted that, if he can survive long enough to be placed in a hospital and prepared for operation, he is not likely to die of hemorrhage *per se*, even though an operation is not performed. On the other hand a vessel wound bleeding so furiously as to demand immediate formal operation would be fatal to the patient before the anesthetic can be administered and sterile linen and instruments arranged.

No more argument is necessary to contend that forceps or ligations, packing or any such method of procedure should not be employed upon vessels in the depths of a ragged contaminated wound. The fact that these procedures are so likely to be followed by sepsis, by hemorrhage and greatly increased liability of gangrene, supports the belief that, even if it is demonstrable that patients do not always die though not operated upon immediately, infection, large hemorrhage and hematoma formation with the dangers of gangrene due

to thrombosis and pressure upon collateral arteries, constitute indications for reasonably prompt action. Delay is often justifiable and may be wise in a case of a clean "dry" wound, bleeding from which may be adequately controlled by moderate pressure, until the patient is carefully transported to the care of a surgeon intimately familiar with the problems of vascular injuries and adequately experienced in the technical procedure of operations.

Acute dilatation of the heart is an immediate danger, the mechanism of which is easily comprehended when it is remembered that normally all the blood which should come into the limb is diverted hurriedly back to the heart. In young, healthy individuals this acute dilatation may be survived; in individuals of middle age and especially with cardiac degeneration, death from acute dilatation of the heart may ensue promptly.

The studies of Halsted,[16 17] of Callandar,[20] of Matas[12] and many others clearly demonstrate that there are a good many real dangers to the life and limb of the patient from these lesions. Extensive proximal dilatation of the artery entails all the dangers of an arterial aneurysm including the subsequent development of gangrene, and in addition Halsted has conclusively shown that dilatation of the heart is a part of the pathology of an arteriovenous fistula.

Is deliberate delay for the purpose of permitting the establishment of collateral circulation a well founded practice? Is there a physiologic or anatomic reason for this belief? On the contrary is there not much reason for believing that the development of collateral circulation is antagonized by arteriovenous fistula? Many cases of arteriovenous aneurysm have apparently caused gangrene partly by the pressure of the sac on the surrounding vessels, partly by infection and partly by arterial thrombosis. Certainly it is amply demonstrated that the normal quantity of arterial blood does not go to the distal portion and this is necessarily followed by diminished arterial calibre followed by hypoplasia. As a

matter of fact sufficient knowledge of the physiology and anatomy of the arteries and veins has already been acquired to demonstrate that there can be no advantage in delaying operation with the idea of establishing the collateral circulation. Is it not true that the most certain way to secure collateral circulation in those areas where it is possible to secure it is to put upon the tissues the necessity for it? It is tissue needs which cause the formation of new vessels and the enlargement of the vessels already present and tissue needs which cause the vessels to function. The researches of physiologists and embryologists[3 4] leave no room for doubt of this fundamental law of biology. We are, therefore, compelled to subscribe to the belief that operation should be performed within a reasonably short length of time following the receipt of the injury; but that it is quite proper and often quite wise to delay operation for a few hours or even days to secure the services of a qualified surgeon, a properly equipped hospital and a clean field of operation. To estimate in practical terms the time for the performance of operations for contaminated and infected wounds implies a comprehension of the three stages of all infected wounds; the stage of contamination; the stage of infection; the stage of inflammation. It must be uniformly agreed that prompt excision of all devitalized tissue (debridement) should be performed as early as possible and with the greatest efficiency within at least twelve hours (the stage of contamination) and the operative wound completely closed as a clean wound. If performed after twelve hours (the stage of infection) the efficiency of the debridement is less than perfect, as demonstrated by the ultimate result. Sometimes the wounds must be reopened and disinfected. Operation performed after thirty-six or forty-eight hours implies almost certainly the treatment of the wound for inflammation and it is no longer open to doubt that inflammation of a wounded bloodvessel is the greatest danger to which it is liable. It is inflammation that results in thrombosis; inflammation that is followed by

secondary hemorrhage; inflammation that causes gangrene. Pyemia secondary to phlebitis constitutes a grave situation. Vascular wounds not operated upon in the first thirty-six or forty-eight hours and in which inflammation does not occur may be operated upon quite successfully at one's leisure based upon circumstances.

It will scarcely be contested, especially since the studies of Neuhoff and St. John,[10] that in every case the incision should be made above the location of the wound of entrance through clean tissue, a "surgical approach." After this a complete debridement, with ample excision of the ragged edges of the vascular wound should be made.

What is the exact status of the preliminary test for collateral circulation in influencing the treatment of the injury to a large bloodvessel? Are the tests absolutely reliable indications, always applicable? And in case the test is negative, is it advantageous to delay action? To observe the downward flush after pressure upon the artery above the injury and accurately time its appearance is obviously not easy to do in negroes, for the flush can only be seen in the nails, the bottom of the feet and between the toes. It is quite obvious that there is considerable margin of error in applying this test and much is dependent upon the personal equation, adequacy of the light in which the test is made and the condition of the eyesight of the observer.

A prick of the toes or feet with a large sized needle or small knife to produce bleeding would also be subject to some margin of error for, if there is a fistulous communication between the artery and the vein, the veins even of the foot are slightly distended and bleed and, even in the absence of this, a moderate amount of residual blood in the capillaries might lead one to a mistaken conclusion. Even though a justifiably deep puncture fails to cause a satisfactory amount of bleeding, does this justify a positive prognosis of gangrene?

A comparison of the surface temperature of the wounded extremity below the seat of injury is attended by consider-

ably more inaccuracy than is the case in the clinical use of the axillary temperature in the ordinary routine estimates; and we can easily conceive that, after a bullet or stab wound involving a large vessel in the groin, the patient might be the victim of cold feet on both sides. Palpation of the peripheral arterial pulse to determine what the condition of the circulation will be tomorrow or the next day is notoriously deficient in giving accurate information. Surgeons have known for years that frequently after injuries in the region of an artery, in which the artery itself is not cut, there is a temporary obliteration of the pulse of the feet and hands. This is not conclusive evidence that the circulation is absolutely cut off. The recent observations of Leriche[19] and for many years by Halsted[17 19] that spastic contraction of the artery at a point distal to the location of the trauma incident to handling large bloodvessels, are quite easily explainable as the result of irritation of the peri-arterial sympathetic nerves. Matas[14] has repeatedly observed temporary obliteration of the pulse distal to aneurysm in cases which at operation showed a patulous lumen of the artery throughout.

We have not seen records in the vast amount of literature upon the surgery of the bloodvessels in which surgeons gave up hope of restoring the circulation and performed amputation because the pulse in the artery distal to the point of operation failed to appear in the first few hours or even days following operation. There are many cases recorded in which the peripheral arterial pulse was days or even weeks in appearing and yet no gangrene occurred. In the case herein reported the pulse in the popliteal and foot are not palpable four months after ligation and yet there is no sign of ischemia. So that it seems that failure of the test of collateral circulation by this means would hardly lead the average surgeon to fail to give his patient the benefit of whatever results might accrue from operations upon the bloodvessels before proceeding to amputate. At the present time, however, can it be said that operations upon blood-

vessels should ever be postponed or abandoned because of the negative test of collateral circulation or should the type of operation be determined by these tests?

When, however, the extremity is cold and pulseless, and especially if it is insensitive to pain or immobile and if this condition is the result of obvious extensive injury of the main arterial trunk and especially if complicated by extensive bone and joint injury which are either actually or almost certainly the seat of extensive infection, it would seem to be standard practice to perform amputation at once without any attempt to repair the bloodvessels. I have had occasion to do this once recently in a case of laceration of the popliteal artery and vein and extensive destruction of the knee-joint resulting from an injury by a shotgun. The problems, however, of such injuries to the knee are quite different from those of the thigh and groin and are well known.

A question of great practical importance in dealing with injuries of large arteries concerns the exact location for the incision. One may assume now that the standard practice to be employed in dealing with any wound in which infection is present is that the seat of operation should be reached through clean, healthy tissue—the "surgical approach." For control of the circulation during the operation this implies that the incision should be made through uncontaminated skin and tissue at a reasonable distance above the wound of entrance. Gentle pressure by means of a sterile pad over the wound of entrance prevents hemorrhage incident to a clean approach to the vessels at a point above the injury. When the vessels are exposed the next question that comes to the surgeon's mind is the use of temporary clamps or ligatures. Digital pressure by the assistant may be reliable enough but his fingers occupy much space and are more useful for other purposes. Various clamps have been of great use while operating upon the femoral, popliteal and the axillary arteries, but do they possess advantage

over the usual silk, catgut or tape ligature in the case of the external iliac which is quite deeply imbedded, intimately adherent to its surrounding sheath and the muscles and fascia in this location? Is it wise to disinter this deeply placed vessel to the extent necessary to employ clamps, or had the circulation better be controlled by means of ligatures which can be adequately placed without difficulty, while the vessels remain *in situ* without denudation and without traction and disturbance of the surrounding tissues? After the temporary ligatures have been placed, and the circulation adequately controlled, it seems fair to assume that sufficient debridement should be performed and all the wounded tissue in the region, inclusive of the ragged edges of the wounded vessels, should be cleanly and adequately excised by sharp knife dissection. With the well-known dangers of infected bloodvessels and the known results of infection and clot formation, it would seem that this excision of devitalized tissue should be complete even though it may be necessary to excise all the ends or perform a resection of the vessels involved. There is ground for the belief that all cases of thrombosis are due to infection and without infection, even in vessels of small caliber, thrombosis does not occur following either a proper suture, or total occlusive ligation.[16] There is further reason to believe that in the absence of infection, gangrene never follows ligation of any part of the external iliac or femoral at a point above its communication with the sciatic through the branches of the profunda femoris.

The next question which presents itself when one is forced to ligate the iliac above its deep epigastric and circumflex iliac branches is: Should these branches also be ligated? In dealing with arteriovenous aneurysm of long standing or with ordinary aneurysm of the artery itself, Halsted's teaching,[19] based upon the sound reason which this eminent surgeon always has for everything, gives reason for ligating these vessels whenever the parent trunk has to be ligated

above and below. Moreover, there are reasons based upon the embryology of the deep epigastric and external iliac arteries which would lead us to believe that they should also be ligated if the parent trunk is to be ligated above and below. These vessels were not deliberately ligated in the case herewith reported and since studying Halsted's contributions I feel that I committed an error in not ligating them. The pulsation in both these vessels was seen before the external iliac was ligated and it was not detected after the ligatures were made tight.

The next question presenting itself after adequate debridement had been performed and the wound clean, involved the question of whether to suture or ligate the vessels. In this case more than half the vessel walls were destroyed by the wound and lateral suture would have been, in my judgment, impracticable. End-to-end anastomosis of the common femoral to the external iliac would have been possible both of the artery and of the vein. A defect of slightly more than an inch would have had to be bridged over by traction of the ends of the arteries or by grafting a segment of vein between the arterial ends. Personally, I would have been unable to do this operation properly within a reasonable length of time. I have no expert skill in bloodvessel surgery and at this stage of the operation, realizing my own limitations, I felt much chagrin at being unable to make a successful end-to-end anastomosis.

A practical point, however, still to be determined in dealing with wounds of the femoral artery and vein, involves this very question. There is reasonable doubt of the preference of end-to-end anastomosis, or vein graft over quadruple ligation and extirpation. To repair a broad defect after extensive disinterment of the artery and freeing it from its bed for a sufficient extent to bring the ends into apposition for anastomosis without tension is of questionable utility. Such extensive freeing of the ends of divided nerves is quite proper but is it safe to employ the same practice in dealing with divided arteries?

Summing up the evidence as I am able to interpret it from the experimental work and clinical observations, there is basis for the belief that end-to-end anastomosis and vein graft may be preferable for small defects in the popliteal following ligation, of which gangrene is not uncommon, but in the case of external iliac or common femoral it remains to be proved that quadruple ligation and extirpation in the absence of infection is ever followed by gangrene.

The literature contains so many records of uninterrupted recoveries following ligation of these vessels in cases in which wound infection could take no part and gangrene following ligation is so rare even in cases in which infection was present, that it is not easy for one to believe that either vein graft or disinterment for relief of tension preliminary to end-to-end anastomosis of the femoral artery can be preferable.

It cannot be questioned that perfect suture is often followed by thrombosis. It is definitely proved that aseptic ligation is not followed by thrombosis. No one can predict if thrombosis does occur how long the thrombus may be and a long thrombus extending up or down the lumen to collaterals may defeat the whole purpose of suture and cause gangrene. Leakage through suture holes can be detected only after completion of suture and removal of temporary occlusion. Any case of sutured vessel from which leakage occurs is practically certain to be followed by thrombosis and may be the cause of perivascular hematoma with all the pernicious effects of hematoma formation in causing inflammation and pressure upon collaterals (potent factors in causing gangrene). Surgeons[24] have repeatedly opened the external iliac artery and removed clots to prevent or cure incipient gangrene. The clinical, the experimental and the logical evidence at the present moment certainly offers much support to the belief that at least for recent and ancient arteriovenous fistulæ involving the common femoral or external iliac vessels completely occlusive ligation of artery and vein with extirpation of the lesion through an

incision giving a clean surgical approach to the field of operation is quite preferable over the most expert suture of the vessels through damaged and, in recent wounds, contaminated, if not infected, tissue.

And finally the question arises when it becomes necessary to ligate an artery should the corresponding vein also be ligated, even though it is not injured? This question, of course, does not enter into the case here reported because the vein was also extensively injured. French surgeons and Makins, of England,[19 5 15] advocate simultaneous ligation of the vein when it is necessary to ligate the artery even though the vein is not injured. Lee,[15] however, working at the American hospital at Neuilly, reports eight consecutive cases of ligation of the femoral in Hunter's canal for popliteal vessel injury without ligation of the vein and all the cases were successful. Neuhoff and St. John[10] believe the vein should be ligated to prevent phlebitis and that it is definitely determined that after vein ligation there is less danger of gangrene. Surely every surgeon would agree that in case of injury of the femoral artery and vein no effort should be made to preserve the lumen of the vein. Indeed, ligation of the vein seems to be of aid in the formation of the collateral circulation. Halsted[19] quotes the investigation of Drummond upon this subject in the case of the vessels in the viscera and refers to the work of Welch and Mall on "intestinal infarction" (soon to be published). The results of these experiments will be of great value in the explanation of the phenomena of gangrene, especially in the bowel. Bowel strangulation by ligature of the artery only, invariably shows more serious change than those treated by simultaneous ligation of both artery and vein. Investigations made for Halsted[19] by Hooker are conclusive of the usefulness of simultaneous vein ligation when the femoral artery is to be occluded.

Halsted[19] states: "We are compelled, I believe, to subscribe to the view that some degree of equilibrium of the

arterial and venous systems must be maintained. Granting this, there vanishes any difficulty that there may have been in accounting for the very high percentages of gangrene observed to follow ligation of the artery in cases of arteriovenous fistula. There is in these cases not only a great enlargement of the venous bed but also a curtailment of the arterial tubage—a shrinkage or hypoplasia of the arteries distal to the fistula. Thus, even before the artery is ligated, the limb is handicapped by this lack of balance. When, now, the artery above a fistula is tied, irrigation with arterial blood is suppressed on one side of the capillary bed and on the other side of it the mixed blood is deprived of a share of the pressure by virtue of which the life of the limb was partly sustained. It seems permissible to conjecture that in some instances the limb distal to the fistula may have been hardly less dependent on the pressure from the venous than from the arterial side, and, if so, we can more readily comprehend the ensuing gangrene than the frequent absence of it after ligation of the fistuled artery." Halsted[19] hints at the wisdom, in the case of vessels like the common iliac, the occlusion of which does not cause gangrene, of postponing ligation of the normal vein when this can be done with safety until evidence of disability should be able conclusively to demonstrate the value of vein ligation.

As to ligature material, silk, catgut, fascia or linen tape, we are not able to get from recorded cases definite and positive proof of the best by test. In the case here recorded we used chromic catgut No. 2 doubled and though I know of no reason to regret it in this case, I shall if I have to deal with a similar injury again, follow Halsted's advice and employ coarse silk or that of Jones and Waits[11] and try a strip of fascia from Poupart's ligament.

I wish in this case we had more completely extirpated the injured portion of the vessels. Callander's cases[20] of recorded arteriovenous aneurysm show 100 per cent. of efficiency of this method of treatment. In the case herein

reported we accomplished almost complete extirpation of the vessel walls between ligatures through debridement.

In this case we placed in the wound for three days a strip of flat rubber to provide exit for possible oozing. There should be no possibility of postoperative oozing in any case of bloodvessel surgery; the wound should be completely closed, perfectly dry and the dressing applied in such a manner as to secure complete immobilization for a few days. Packing and pressure are pernicious practices.

Observations made upon injured bloodvessels have added much of practical value in the study of physiology of the circulation and will explain many phenomena which have been commonly observed and heretofore unexplainable. Wounds of large arteries are invariably followed, at least for a few hours, by contraction of the artery for some distance below the wound and cessation of the pulsation. This might account for the clinical observation that, frequently with wounds even of some size in a large arterial trunk, there may be no bleeding for several hours following the wound and in wounds of large arteries even independent of arteriovenous fistula observed during the war, blood is often so small in quantity that the war surgeons spoke of them as "dry wounds" of arteries.[5] When there is a communicating wound with the satellite vein and blood is passing directly from the artery into the vein, this is another type of dry wound. It has also been a common observation, both by experimentalists and practical surgeons operating upon bloodvessels in human beings, that during the manipulations of an artery incident to whatever operation may be performed, the vessel within the area which is being traumatized and for some distance, if not throughout its entire extent below, the artery becomes contracted down to perhaps half of its original size.[17 19] Following this period of contraction, however, after several hours there occurs dilatation during which there will be increased flow of blood into the extremity as shown by various instruments

of procedure for detecting the blood-pressure and temperature. This phenomenal preliminary contraction and reactionary dilatation are readily explainable upon the effect of dilatation and destruction of the peri-arterial sympathetic nerves.[19] Irritation of these gives contraction; destruction results in dilatation or vasomotor paresis. Dilatation of the capillaries preceded by preliminary contraction invariably occurs when the vasomotor nerve of the arterial trunk or of the capillaries is destroyed. The capillary bed when dilated by vasomotor paralysis or by toxic substances in the blood, favors blood retention and thus tends to keep open and full of blood the capillary spaces for tissue nutrition.

The significance of the peri-arterial sympathetic nerve fibers may prove useful to explain certain phenomena referable to the symptoms and signs produced by arterial injuries and may have a wide influence in determining the time for and method of operative treatment. W. S. Halsted[19] has exhibited interest in this subject and will doubtless eventually give us much specific information. Injury to the wall of the arteries seems invariably to be followed by spastic contraction of the artery for a variable distance peripherally. This may account for the fact often observed that wounds of large arteries often remain "dry" for six or eight hours.[5] During this period of arterial contraction at which time the distal pulse is obliterated by spasm there is liability to error in believing that the artery is occluded and the extremity in danger of gangrene. Following the period of spastic contraction there occurs wide arterial and capillary dilatation with hyperemia of the part, increased local temperature and other reactionary phenomena. From these facts would it not seem quite wise in dry wounds to wait for the subsidence of contraction from peri-arterial sympathetic nerve irritation before operation for such an injury? There are other causes for dry wounds of arteries. The blood may flow from the artery directly into the vein and consequently not escape in the form of systemic hemor-

rhage. The patient bleeds into his own vein, the tissues distal to the injury are ischemic. Wounds may be dry, therefore, though this constitutes no positive evidence that the artery has not been injured. The peripheral pulse may be entirely obliterated and this is not positive evidence that the lumen of the artery is occluded. Both these phenomena may be due to peri-arterial sympathetic irritation.

These phenomena may account for many cases recorded in literature in which on account of failure to detect the pulse in the feet and hands it was assumed that the artery was blocked by thrombus. Pulseless and cold hands and feet may not necessarily therefore be regarded as doomed to gangrene. Failure of return of the peripheral pulse within a period of eight hours after injury or operation constitutes no reason for grave anxiety. Later than this the presence of vascular dilatation due to paresis of the vasomotor mechanism will be of great service in aiding the establishment of collateral circulation. Is it probable that the paralytic vasomotor dilatation may be more complete when the main arterial trunk is boldly ligated and excised than when it is more carefully handled as of necessity it must be for successful suture?

Reading the literature, especially clinical reports of cases of injury to bloodvessels, one is impressed by the great variability of the character of observations made and by what seems to be inconsistent and at times impossible signs representing injury or an operation. There are many records of injury to the femoral and popliteal arteries followed immediately by absence of pulsation in the dorsalis pedis or of one of the tibial arteries for a few hours following injury and later a return of pulsation and circulation perhaps independent of any operation or any treatment. The special importance of the knowledge of this effect of arterial sympathetic irritation and destruction has to do with certain of our interpretations with reference especially to the testing of collateral circulation before operation and of the

assumption which we are likely to make that this natural subsidence of arterial contraction resulting in dilatation and restoration of the pulse-wave is also a result of treatment. It is conceivable that the return of the pulse in the dorsalis pedis artery might follow ligation of some artery in the region of the large trunk like the iliac or femoral and during the surgeon's distress at the sight of such a hemorrhage he may have thought it to have been the large vessel itself. Suppose, for example, during an operation for hernia an amateur surgeon should cut one of the epigastric or circumflex iliac branches of a great arterial trunk, he would be excusable if, during the distress of the situation, the volume of blood looked as if it were enough to have come from the femoral, and then, immediately after tying the smaller artery (though perhaps with some trauma to the parent trunk), he should find an hour or so later that the pulse in the dorsalis pedis was not palpable, it would not necessarily follow that he had tied the femoral artery. Moreover, a return of pulsation in the foot and ankle arteries as promptly as within an hour or so after the ligation of a large trunk like the femoral, would not necessarily indicate the establishment of collateral circulation. If looked at critically, this would lead one to believe that it was not the femoral which had been ligated but some other artery in that vicinity. A few hours is ample for the pulsation coincident upon the reactionary dilatation following peri-arterial sympathetic irritation, but it is not possible to reëstablish collateral circulation sufficient to cause pulsation of the dorsalis pedis within a few hours after ligation of the common femoral. In the case herewith recorded pulsation of the vessels in the foot, even of the popliteal, cannot be detected and it has been four months since the iliac was ligated. There is abundance of blood in the limb, the superficial veins are full, though not markedly distended, and the patient knows no difference in the sensations and usefulness of the injured from those in the uninjured extremity.

Next to the saving of life through the prevention of hemorrhage, a surgeon naturally hopes to save the limb through the prevention of gangrene. If the external iliac artery is deliberately ligated or if following suture it becomes accidentally occluded by clot formation, will the tissues in the limb distal to the point of occlusion receive nutrition and, if so, how? The description of the artery in the literature of descriptive anatomy, practical anatomy and surgery speak of collateral circulation through anastomosis of arteries. They say, for example, that after ligation of the external iliac artery the collateral circulation is carried on by anastomosis of the branches above the point of ligation of the main artery with the branches of the parent trunk below the point of occlusion. From these statements we are led to believe that the terminal branches of the artery above actually become united to and communicate with the terminal branches of the arteries below. Does this mean that the capillary bed is to be ignored and that blood passes directly from the distal end of an artery above into the distal end of an artery below and then pursues its course in reversal to the normal physiologic course of blood in arteries back to the parent trunk?[7] Diagrams illustrating this method of connecting up the arteries and reversal of arterial circulation are pictured in many text-books and seem to be accepted as a matter of fact by surgeons. Must we believe in such a distortion of normal physiology? It has been repeatedly demonstrated by Horsley,[22 23] Stetten[8] and many other investigators that reversal of circulation of arterial blood from arteries to veins is impossible and it is not easy for us to believe that blood can pass from one artery through the capillaries back into the arterial capillaries and then in a reverse direction through another artery. This question might be determined by experiments in a living animal, although I can find no record of it having been done. On the other hand it is quite conceivable and, indeed, easily demonstrable that those arteries constituting

the posterior branches of the aorta do actually communicate with arteries having a location anteriorly, and this union results in forming arterial loops. Illustrations of this normal loop formation are noted in the intercostals. The posterior intercostals actually communicate with the anterior intercostals and when an intercostal is cut bleeding occurs from both ends. Such a vascular loop is also formed by the right and left gastro-epiploic artery on the greater curvature of the stomach and with the uterine and ovarian artery forming the arterial loop of Byron Robinson, and is the method of formation of arterial arches in the feet and hands. The phenomenon of arteries emptying into arteries is also exhibited in certain places in the brain as on the outer aspect of the dura mater and is the actual cause of the formation of the circle of Willis.

It is well known that the ligation of one internal iliac artery will not curtail (even temporarily) the amount of blood going to the uterus and other organs supplied by these vessels. This is clinical evidence of the probable existence of arterial loop formation by the terminal junction of the internal iliacs. When it is remembered that the internal iliacs are the continuation of the common iliacs and that these are homologous with the lumbar and intercostal arteries, this loop formation by inosculation is exactly what we would expect. The disappointment caused by failure of ligation of both internal iliacs and both ovarian arteries to cause starvation of uterine cancer is incident to the fact that this organ receives also blood from branches ultimately coming also from the external iliac and inferior mesenteric arteries and other sources. To strangulate the stomach by ligation of the celiac axis or the small bowel by ligation or thrombosis of the superior mesenteric is easy enough. These arteries are anterior branches of the aorta. But to produce total ischemia by single ligation of a dorsal segmental branch of the aorta is a different proposition, because of the normal inosculation of these with each other through

communicating branches of the arteries of different segments and because of their communication with their own anterior branches. The posterior branches of the dorsal intercostal and lumbar arteries communicate above and below the point of total occlusion of the abdominal aorta; and the reason for efficient circulation through the communication of epigastrics from above and below is easily comprehended when we remember that these vessels represent essentially the terminations of dorsal segmental branches of the aorta in embryo; the superior epigastric from the internal mammary (homologous with posterior intercostals) and the deep epigastric (though of independent embryonic formation) from the iliac (a greatly enlarged lumbar artery), a dorsal segmental branch of the aorta. We, therefore, quite properly speak of inosculation of arteries by which we mean that the terminal branches of two arteries may actually communicate forming a loop, and an anastomosis of arteries by which we understand that terminal branches of various arteries in a given region of the body become intimately in contact with each other and to the naked eye appear to mix with each other, but in which there is no evidence that the blood actually passes from one artery into the other.

It is quite obvious that the large amount of blood brought to various organs and tissues by the abundance of smaller branches from different arterial trunks is adequate to maintain nutritional needs. This fact is demonstrated in every operation where ligatures are employed to check hemorrhage, by the failure of so-called "starvation methods" of treating cancer by ligation of incoming vessels, and causes genuine skepticism concerning the utility of ligation of thyroid arteries for the purpose of diminishing the amount of blood coming to the thyroid gland. On the other hand the sudden occlusion of a large artery like the femoral or axillary in cases of great peripheral engorgement due to elephantiasis[19] or venous blocking by cancer adhesions may

cause temporarily some relief of swelling by curtailing the amount of inflow. Ligation of both external carotids has likewise caused temporary cessation of pulsation in cirsoid aneurysm of the scalp. A true collateral circulation implies a simple enlargement of the normal inosculation of arteries forming a communicating loop when the necessity for this performance is brought about through the imposition of additional function after ligation of one part of the loop. Is it true, however, that in other parts of the body, where such loops are not formed normally, their formation can be brought about by ligation. It seems that fundamental considerations of normal anatomy would go far toward giving us a satisfactory explanation for the repeatedly observed clinical fact that gangrene should never occur after a single ligation of the aorta or common iliac or internal iliac; that it will never occur after ligation of either one of the arteries forming the arches in the feet and hands, nor of an intercostal nor of certain other vessels having such a normal communication with each other by inosculation. The clinical observation that gangrene frequently occurs after ligation of the popliteal artery is explainable when we remember that there is often no companion artery with which the popliteal or its branches can communicate through inosculation. But for the persistence of a patulous portion of the popliteal anterior to the popliteus muscle (its embryonic location)[1 2] and the possibility of establishing communication between this and one of the tibials or the peroneal below, would not gangrene always result from occlusion of the popliteal?

The real explanation of the method of formation of collateral arteries must of fundamental necessity take into consideration the original mode of formation of these vessels in embryo and of the part played by the physiology of these structures in relation to their formation and of the physiology of bloodvessels in adults. In this way we may find it possible to explain certain clinically unexplainable phe-

nomena, and inestimable aid may be secured in the explanation of certain phenomena, constituting problems incident to bloodvessel surgery. This constitutes a large field for speculation and we shall expect some philosophical mind like that of W. S. Halsted to put together the various scientific facts and give us a basis upon which to act intelligently in the practice of clinical surgery.

The origin of bloodvessels in embryo is apparently independent of the origin of the heart.[3 4] The first bloodvessels in embryo are formed in the periphery and actually antedate in point of time the appearance of the embryonic heart. The origin of bloodvessels constitutes no exception to the fundamental biologic laws as enunciated by Roux, Thoma and others[3] that they are the product of tissue needs; that the function of tissues is the real cause of the formation of the tissues—in other words that function fixes form, that physiology is the cause of anatomy. Capillaries are the product of specific cells designated by embryologists as angioblasts (Sabin). The capillaries are not formed as a result of the blood stream but of tissue needs for food and effete material. After, however, the formation of the heart and the communication is established by its capillaries through the arteries and veins, the further development of these structures is markedly influenced by the volume of blood,[31] perhaps the blood-pressure, and by the function of the capillaries in effecting an interchange of nutritional and effete material to and from the tissue cells. To facilitate this function there must of necessity develop a complicated physiologic mechanism based upon chemical action and nervous mechanism. As factors in the dynamics of the circulation Hooker[31] has clearly demonstrated the great importance of the capillaries and the venules and the demonstrations of this physiologist are of great practical importance in the explanation of collateral circulation. This constitutes further evidence in support of the biologic law that function causes form. He has shown that the physiologic needs of the cells distal to

ligation take active part in causing the remaining arteries to bring more blood and causing both the increased caliber of arterial branches and the formation of new branches adjacent to the point of occlusion. And, finally, of great importance the tissue needs result in the reëstablishment of function and of patulency to arteries which have become atrophic and hypoplastic in postnatal life and which in the period of development played a great part in physiologic action and were arteries of large size. The application of this fact for example, to the formation of collateral circulation after ligation of the femoral or external iliac artery would lead us to predict with a belief close to certainty that the collateral circulation would be brought about through the reëstablishment of circulation through the sciatic artery and its inosculation connection with the deep femoral through the perforating branches developed from Senior's plexus of communication between these vessels in embryo.[2]

The researches of Senior[1 2] published in 1919–1920 upon the embryology of the arteries of the lower extremity have resulted in the discovery of facts which when taken in their practical application to the question of the mode of formation of collateral circulation or of the substitution of function of one artery when, as a result of ligation another artery is rendered functionless, are capable of throwing some light on the mechanism of the maintenance of circulation in the area distal to the application of the ligature. And it will be interesting when the reports of vessel ligation are tabulated to note the conformity of results obtained in practice with those which should have been anticipated through a proper comprehension of the development and origin of the bloodvessels of the lower extremity. It has been known for many years that in early embryonic life the arterial supply to the lower extremity was through an artery, the remains of which in an adult is the sciatic, and that the external iliac-femoral artery did not exist in the earlier

stages of embryonic life, but is a later development from the embryonic umbilical artery which in the mature fetus is the common iliac. Though the deep epigastric artery is apparently a branch of the external iliac there are evidences of formation of the epigastric at an earlier period in the life of the embryo than of the formation of the external iliac.[1 2] Soon these two vessels become joined and about this time the external iliac divides into two companion arteries which either coalesce or one of which disappears; somewhat later the common femoral divides into two terminal branches, one of which is called the saphenous which becomes the new superficial femoral of the main trunk of the thigh and the other persists as the profunda femoris. The femoral artery, therefore, though a later product than the primitive sciatic, grows with very much greater rapidity and to a much larger size.

Almost coincident with the division of the primitive femoral into its two branches, there develops from the sciatic which at this stage of the embryo is called the axial artery, reaching from the epigastric all the way down the extremity to its terminal plexus in the foot, from the ischiatic portion of the axial artery there develop recurrent branches called the rami communicantes. These grow upward toward the developing femoral and end in a distinct plexus called by Senior,[2] the rete femorales. In this collection of terminal arterial capillaries at least a portion of the blood stream passes directly through from the communication plexus of Senior to and from the femoral and the axial arteries, though a part of the blood is also drained to the venules in the usual way.

In the embryo Senior[2] has shown that the plexiform arrangement between the terminal branches of the rami communicantes from the axial and the terminal portion of the femoral actually exists. He has not been able, however, to demonstrate such a plexus arrangement in any other portion of the lower extremity except the portion of

the artery ending in the foot and which represents ultimately the arch formation. Even around the knee he was unable to demonstrate this plexiform arrangement. The plexuses, however, are certainly demonstrated in the region of the communication between the sciatic and the femoral.

As the femoral grows downward it comes in contact with the axial and seems to take possession of the blood in this vessel and passes on downward. After union with the femoral the portion of the axial just above the communication with the femoral, becomes smaller and ultimately is indistinct. The portion of the axial below the connection with the growing femoral remains and is represented by the popliteal which divides in the process of formation, into three adult arteries, the anterior and posterior tibial and the peroneal. Thus, it seems from the standpoint of embryology that in the upper part of the thigh there are two main arterial trunks—the external iliac-femoral and the sciatic; in the region of the knee the popliteal is the sole arterial supply and below this there are three vessels. It would follow from this that the most dangerous vessel in the lower extremity for ligation, so far as future blood supply is concerned, is the popliteal and this conforms to clinical experience.

In the early embryo the part of the axial remaining as the popliteal is located anterior to the popliteus muscle. As a result of the development of this muscle, the popliteal artery becomes posterior to the muscle, though with some frequently the primitive popliteal remains as a patulous branch located between the muscle and the knee-joint and gives rise to the anomaly of a double popliteal artery. It may be that this anomaly can account for the fact that gangrene does not result from every case of ligation of the popliteal artery. Are we justified in the belief, therefore, that the collateral circulation brought about by the ligation of a large arterial trunk occurs in the simple unphysiologic method by which it is demonstrated in most text-books of

surgery or must we readjust our views and believe that the laws of development which operate in the embryo are obeyed when the functional necessity for such blood circulation is brought about artificially either through surgical operation, accidental injury or arterial thrombosis?

I would suggest as an explanation of the origin of collateral circulation that after ligation the mode of circulation of the blood reverts to the vessels through which it circulates in embryo. These vessels, when the common femoral or external iliac artery is tied, are the sciatic and branches of the profunda femoris. This mode of explanation is in conformity with the clinical observations that perhaps in only two recorded cases was ligation of the external iliac more than contributory to the cause of gangrene; and in these two cases, Kummel's occurred after ligation of the profunda branch of the femoral and that of Meyer after ligation of the internal iliac, the parent trunk of the sciatic.[17] It is to be noted that in both these cases, in addition to the ligation of the external iliac, occlusion of the internal iliac in one and of the profunda femoris in the other was also performed and the entire arch of inosculation was thereby destroyed.

The remarkable case of Neuhoff and St. John[10] records the following ligations after an extensive war injury of the thigh: the femoral artery had been ligated immediately; following this as a result of infection there were eleven hemorrhages; on the twenty-third day the femoral vein was ligated; on the thirty-fourth day the external circumflex (?) was ligated and on the same day the femoral artery was religated; on the fiftieth day the profunda femoris (?) was ligated; on the eightieth day the profunda femoris (?) was religated; and finally through a clean surgical approach the external iliac artery was ligated and five weeks later the wound was healed without gangrene and the patient was evacuated. It will be noted that the report does not state with absolute certainty that the profunda femoris was

ligated; it was thought to have been done twice, once on the fiftieth day and once on the eightieth day. This case is instructive and gangrene failed to follow either because there was a long interval before the first ligation of the profunda femoris and another interval of thirty-four days before the second ligation of this vessel during which time the collateral circulation from the sciatic was well established. It will also be noted that on the twenty-third day a large vein, probably the femoral, was ligated. Was this also influential in prevention of gangrene? The case is a good demonstration of the effects of infection in causing secondary hemorrhage and immediately satisfactory success of ligation of the external iliac through a separate incision, the surgical approach.

The brilliant work of Hooker[31] has shown in beautiful fashion the nervous and chemical mechanism by which the capillary bed is active in the dynamics of the circulation. He has shown for example that oxygen, adrenalin and other food substances cause contraction of the capillaries while CO_2, lactic acid and histamine and other catabolic substances cause great dilatation of the capillaries. Of great importance was his remarkable observation that after the death of the animal there regularly occurs alternate contraction and dilatation of the capillaries, reciprocally with the venules through which blood has passed from capillaries into venules and from venules back into capillaries. But not in a single instance was the blood observed to be carried from the capillaries into an arteriole. The capillary constriction was seen to sweep blood in a peristaltic fashion from the capillaries into the venules during a period of 15 minutes or more after which a remarkable relaxation of the venous side occurs, the capillaries again becoming filled by blood flowing from the venules into the capillaries and this stage lasts forty-five minutes or more. Finally, coincidently with rigor mortis capillary contraction occurs and they remain empty. This is the beginning of gangrene.

This remarkable phenomenon was controlled by chemical substances and a nervous mechanism, and constitutes the major process of control by which extensive capillary areas may be emptied and packed with blood and plasma passed into and out of the tissue spaces.

Further observation illustrating the difference between the behavior of capillaries related to arteries which communicate directly with each other through inosculation are the observations that after ligation of the carotid artery and in the vessels of the omentum preliminary contraction did occur. Hooker's explanation of the contraction is that it results from asphyxia; asphyxia does not occur in tissues supplied by arteries which actually inosculate with another unless both ends of the artery are tied. In other arteries the branches of which do not inosculate but merely anastomose, ligation is ample for asphyxia.

The clinical observations made especially by the English and French surgeons during the War[5] that after ligation of the large arterial trunk in the extremity, gangrene was less likely to result if the companion vein was also ligated, is quite easily explained by the studies of Hooker and others that catabolic chemical substances such as are contained in the venous blood cause dilatation of the capillary bed of the periphery and this is in conformity with the common-sense suggestion that, if the amount of blood entering a limb is diminished or cut off entirely, we should at least be sufficiently considerate of the tissues to tie the vein and permit what will of the blood already present to remain. Halsted[19] heartily endorses the suggestion that if the large artery must be ligated a ligature should always simultaneously be applied to the vein even though this is not injured and at his suggestion Hooker made some interesting observations[19] upon the blood-pressure in the branches of the femoral artery after ligature of the artery alone from which there was an immediate fall of pressure from 114 to 20 mm. Within an hour's time the pressure rose to about 50 mm.

Was this due to the dilatation from peri-arterial sympathetic paralysis? When pressure was made upon the main venous trunk there occurred an immediate rise of pressure in the artery sometimes as much as 21 mm. of mercury. The test for several hours gave uniformly similar results. This observation is in strict conformity to the teachings of physiologists that increased blood-pressure is a potent factor in the development of bloodvessels and that the cause of the formation and enlargement of bloodvessels is the volume of blood in the tissues.

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DISCUSSION ON THE PAPERS OF DRS. BAILEY AND LAROQUE

Dr. C. E. Caldwell, Cincinnati, Ohio.—If I may be excused for going into this question from an anatomical standpoint I should like to go back twenty years ago when Dr. Wyeth was in Cincinnati. I had been working a long time in the anatomical room and I timidly suggested, instead of the Wyeth pins, another procedure might be effective in controlling hemorrhage, and that was preliminary ligation of the common femoral artery, making such a flap as Murphy subsequently made in arthroplasty of the hip, carrying the incision around and having control not only of the vessels very near the femur but the sciatic and gluteal. As a result of carrying the flap around it is easy to control the posterior flap by thrusting a double ligature of rubber through the posterior portion of the thigh, dividing that and carrying it out so that it will not slip on that side to the posterior flap and completing the incision and controlling the hemorrhage. The advantage of that operation over the one which I feel is very successful in Dr. Bailey's hands is this: I do not believe you wish to do a complex operation if a simple one will answer the purpose. I cannot conceive if a patient is already suffering from shock why he should be subjected to a prolonged operation, for the reason that ligation of the common iliac, after all, is not so easy in the hands of even the most expert surgeons, and it cannot be done in a few moments. It requires an abdominal operation, and that is adding complexity to the operation which is unnecessary.

While I have done a large number of amputations very high in the thigh, it has never been my good fortune to have a case in which it was necessary to amputate at the hip-joint. Disarticulation of the hip can be easily done through this flap carried over here (indicating); the neck can be sawed through, the head removed and one can dislocate the femur and completely control hemorrhage and the postero-anterior flap. For that reason if I were to do this amputation, and I look forward to the possibility of getting such a case, I feel perfectly sure hemorrhage can be adequately controlled as well by this method as by the more complex one of ligation of the common iliac.

Dr. Stephen H. Watts, Charlottesville, Virginia.—If ligation of the common femoral artery is as safe as it seems to be

it has occurred to me that it might be well in certain cases of rapidly growing sarcoma of the leg to tie the common femoral artery on the basis of the starvation treatment of malignant growths and then apply radium.

Dr. C. E. Caldwell, Cincinnati, Ohio.—I doubly ligated the common femoral artery for a stab wound, and there was no evidence of any delay in the reëstablishment of the circulation.

Dr. E. Denegre Martin, New Orleans, Louisiana.—When a medical student at the Charity Hospital I assisted Drs. Souchon, Logan and Miles in a disarticulation at the hip without primary ligature or constriction. Dr. Miles controlled the vessels by digital compression and Dr. Souchon operated. With a long knife he thrust the blade through the soft tissues, transfixing the thigh and opening the capsule at the same time; the blade was brought out anteriorly, making a flap eight or ten inches long, the limb disarticulated and the knife carried through the tissues posteriorly, making a posterior flap. There was quite a little bleeding, but this was easily controlled. I was astonished at the dexterity and rapidity with which this part of the operation was performed. I do not think the whole operation consumed more than twenty minutes. I have had two disarticulations of the hip in my practice, both for sarcoma; the hemorrhage in each case was controlled with the Wyeth pins and tourniquet. One lived one and the other twelve years after operation, dying with a recurrence in the lung. Primary ligature is probably safer, but certainly complicates the operation.

Dr. Hubert A. Royster, Raleigh, North Carolina.—Referring to the case reported by Dr. LaRoque, I should like to record a similar experience of my own, which I have never reported. About twelve years ago I operated upon a girl, aged fourteen years, for inguinal hernia. She had worn a truss for many years in the wrong place, high up and not over the ring. The truss was a hard one without padding, so that it had thinned out the skin and tissues underneath, a fact of which I was not aware. When I made the incision down through the skin and external oblique I came down upon the vessels, and in fact went into the external iliac artery. I placed my finger over the spout and ripped up the wound; in doing so I injured the vein, which bled even more than the artery. I then deliberately double-ligated both of the vessels well above the

brim of the pelvis, cut between the ligatures, finished the operation for the hernia and put the patient to bed, with the limb covered with cotton and surrounded with hot-water bags. She made an uneventful recovery without any trouble in the limb. It was cold for about three hours, during which time I offered many invocations. That girl is now twenty-six years of age, is perfectly well and not the slightest disability has resulted.

A few weeks ago I was talking to Professor Halsted about this question, and I spent a most interesting hour and a half with him, during which time he told me more about bloodvessel surgery than I had ever been able to find anywhere. I agree with Dr. LaRoque that this question is much more a matter of surgical philosophy than of technic.

I had felt for many years that ligation of both of these vessels at this point would result in disaster and that it should never be done under any circumstances; but I think the fact has been proved by these interesting cases today, that when the vein is ligated at the same time we not only do not destroy our chances but perhaps improve them.

Dr. Alexius McGlannan, Baltimore, Maryland.—Something like two years ago a most pitiable individual was brought to the Mercy Hospital. He had been treated for a long time by a cancer quack for sarcoma of the lower end of the left femur. He had been treated with caustics until apparently the bone had come through the soft parts, making a huge fungus which extended practically to the upper fourth of the thigh. His leg was flexed at the knee. The knee-joint was open. The fungus was infected. The man was desperately ill from septicemia, and we felt he had internal metastases from the tumor. Disarticulation of the hip was done after ligation of the external iliac extraperitoneally. We had very little blood from the posterior flap, which was easily controlled by clamps. He recovered from the operation and lived four months, at the end of which time he died with internal metastases from the sarcoma.

Dr. Bailey (closing the discussion on his part).—I wish to thank the gentlemen for their liberal discussion and criticism. Dr. Caldwell's remarks are indeed welcome, yet I believe he thinks I suggested preliminary ligation as a routine procedure in all amputations of the hip-joint; if so, he misunderstood my suggestions. I remarked that in cases of extreme emergency, such as I considered the case upon which I operated, the loss

of even an ounce of additional blood in the presence of active infection meant considerable increase of danger. I also stated that I believed the abductor group in this case had become involved in the growth and should be resected high. That would have made it inconvenient to use pins and tourniquet. It is necessary to get above any tourniquet you can place in the crotch if you wish to completely remove a muscle group. Malignancy frequently invades the muscular structures rapidly, and complete extirpation is the only hope.

I have had one previous disarticulation, which was done by the Wyeth method, and with as little bleeding as could possibly follow and with excellent result. However, I do not believe hip disarticulation can be done in a bloodless manner. I have seen at least five disarticulations of the hip-joint, and I should dislike to say how many high amputations of the leg I have been forced to see or do, during the last few days, of each drive especially, and except in selected cases and unusual conditions, the method of Wyeth is most acceptable. No one believes in amputating except when positively indicated. There are certain cases in which the margin of safety is narrow, and in these, if we can save the patient additional shock, minimize loss of blood and remove *in toto* all invaded muscle groups, preliminary ligation of the common iliac is both safe and practical in experienced hands. One will be surprised at the ease of exposure and ligation, and sufficiently repaid by the rapidity with which the stump vessels are controlled during the disarticulation.

Dr. LaRoque (closing the discussion).—The reason I asked the question about bleeding was because Senior has shown by studies of embryos that the deep epigastric artery is independent of origin from the femoral or the external iliac. It becomes connected with and apparently empties into the external iliac in embryonic life. Ligation of the common iliac artery will not stop the circulation going from the superior epigastric through the deep epigastric because these two arteries inosculate with each other.

The other thing worthy of emphasis is that there are only two or three if *any* cases recorded in the literature in which gangrene was caused *solely* by ligation of the common or external iliac arteries. And now with the known advantages of simultaneous ligation of the accompanying vein when it is necessary to tie the artery, there seems little reason for excessive anxiety after aseptic ligation of these vessels through a clean surgical approach.

GASTRIC AND DUODENAL ULCERS

By Charles H. Mayo, M.D.
Rochester, Minnesota

The accident of peptic ulcer, for such I believe it to be, is rare; it represents but a fraction of 1 per cent. of the findings of general necropsies. In the aggregate, however, the condition occurs in thousands of persons, many of whom, apparently, never suffer from symptoms of gastric trouble; others do not appreciate the symptoms. Undoubtedly some persons have hyposensitive abdomens and experience little reaction from acute or chronic disease; conversely, persons with little pathological foundation have grave symptoms. In the former the presence of ulcer might first be surmised by hemorrhage, perforation or obstruction. The majority of persons who have ulcer of the stomach or of the duodenum have well-marked symptoms, almost sufficient from which to make a diagnosis without the corroborative evidence of the roentgenographic or fluoroscopic examination. Peptic ulcer occurs in all climates apparently with all types of food and in all races; seasons, spring and fall, increase the symptoms to some extent. During the period when acute and chronic bleeding and perforation and mechanical obstruction were the main diagnostic points of ulcer, bleeding was much relied on in making a diagnosis. These symptoms lost their importance as diagnostic ability improved, and so many cases of ulcer were added to the list that the incident of hemorrhage was reduced to approximately 20 per cent. in the cases diagnosed.

Peptic ulcer is more common in males than in females, the proportion being 3 to 1. The proportion of gastric to duodenal ulcer is approximately 1 to 4, as shown by reports from the Clinic, where from January 1, 1906, to January 1, 1920, operations were performed on 1191 patients with gastric ulcer and on 4532 patients with duodenal ulcer. A very small percentage of patients have ulcers in the stomach and in the duodenum; in only 203 instances during the fourteen years were both gastric and duodenal ulcers found in the same patient. In a series of 638 patients with gastric ulcer observed in a five-year period, twenty-eight had multiple ulcers. Sir Berkeley Moynihan has called attention to the occurrence of this condition.

As to the etiology: I believe that peptic ulcer is undoubtedly developed by a combination of local chemical effects, possibly causing prolonged vessel spasm or claudication, a counterpart of Raynaud's disease or scleroderma, or by direct interference with the circulation through infarction emboli of bacteria, chemically and mechanically active in the tissues, and thereby lowering the local resistance to the action of digestive fluids. The two, a changed circulation and peptic action, are most surely associated early. In the diseased tissue, during the periods of varying activity and remissions of chronic ulcer, bacteria can be cultivated from excised ulcer tissue which has been made wholly free from surface contamination. If the cultures grown in such experiments are injected into animals similar ulcers are produced in a high percentage of cases. Rosenow has shown the bacteria cultivated from the tissue of an excised ulcer of the stomach to be the same as those cultivated from the abscess around the root of a tooth. The cultures from each repeatedly injected intravenously produced ulcer of the stomach. A like condition was produced experimentally by cultures from a blind abscess pocket in a small uninflamed tonsil in one other case. In the chemistry of the bacterial products, I believe, lies the explanation of

the chronicity of the disease. That ulcer is not produced by traumatism is the testimony of surgeons who operate on persons who have accidentally swallowed sharp or hard substances, and on the insane who have swallowed their table cutlery, nails, hairpins and similar indigestible material. Ulcer is rarely produced by direct external traumatism; if it were the greatest difficulty would be experienced in healing incisions for gastrotomy or gastro-enterostomy, as in securely adjusting the approximation against leakage and hemorrhage devitalization by suture of the incised area is an essential in the operation.

Practically all ulcers of the duodenum occur in the first portion between the entrance of the common duct and the pylorus, which should be called the antrum or vestibule of the intestine. In this space the acid chyme which is still active with pepsin is held until it is neutralized in the area of Brunner's glands by a secretion apparently called forth by the presence of food in the stomach and not by the acid, although the action is evidently neutralization and preparation for alkaline digestion. The loss of harmony of action in the neutralization process may be an added factor in some cases in the occurrence of ulcer and recurrence of ulcer symptoms. Cannon showed the closure of the pyloric ring to be due to acids. When the acids in a bolus are neutralized the muscle relaxes and the next bolus escapes from the stomach; the gastric peristaltic waves are ineffectual until neutralization is complete. If this observation were not correct, peptic ulcer could occur in diminishing numbers down the upper intestine, since the neutralization of the acid chyme could be accomplished and intestinal digestion continued by an extravagant waste of the digestive alkalies of the upper intestine and glands. Ulcers occasionally appear in the new opening. With cholecystogastrostomy an open pylorus is maintained by the alkaline bile, although nothing leaves the stomach without peristaltic action. The same condition is present in achlorhydria. External

pressure on the stomach is seen easily to force the barium into the intestine.

Reeves and others have shown that the anatomical arrangements of the arteries along the lesser curvature of the stomach, in which parallel arterioles supplied at both ends by arterial majors give an opportunity for some stasis, and a triangular supply throughout the first two inches of the duodenum predispose to thrombosis. Should certain bacteria be present in the blood supply they may as emboli destroy a local area of circulation. Tissue infiltrated with bacteria by chemical action may prevent healing. The relationship of pepsin and acid has always been recognized as associated with the development of these so-called peptic ulcers. The surface ulcers on the mucous membrane may be produced experimentally in numbers by certain toxic materials, other than bacterial, injected into the circulation or administered by mouth, but such ulcers are fleeting; they are not considered in this discussion.

Doctor Sippy, of Chicago, one of America's greatest internists, should be credited with having done the most to coördinate medical thought with regard to the condition of gastric ulcer and its medical treatment, which is based on changing the environment of the ulcer area by controlling the corrosion of gastric acids during exacerbations. He has shown that the combined acids have little to do with activating pepsin during the period ordinarily given for digestion and that free acid is the activating agent. The medical treatment of gastric ulcer in an exacerbation during waking hours is directed toward controlling and lowering this acidity by dilution or neutralization of gastric contents at regular periods. The food which is permitted during one period has a fairly high percentage of fat which delays digestion, such as milk and cream; the next period is given to alkalies. This procedure is carried on while the patient is awake and in bed, while the symptoms are acute. Patients are under surveillance for a long period with repeated tests

of the stomach's contents and a regulated diet. Such treatment, although effective at least in affording relief, can seldom be obtained by the majority of those afflicted; the patients may be too poor or for other reasons so situated that they cannot secure the treatment. Because of the years of disability, patients with recurring attacks who are cared for in hospitals and out represent a fairly high percentage of gastric ulcers as compared with other diseases. Freedom from symptoms following an attack does not necessarily mean a healed ulcer; however, it must be said that some patients are relieved medically to their satisfaction. While patients are being cared for during many years of recurring attacks some develop conditions, such as hemorrhage, obstruction and perforation which demand immediate surgery, and not a few develop cancer on ulcer of which approximately 25 per cent. remain confined to the stomach (a local disease) until death occurs. Ulcer of the duodenum, however, rarely develops into malignancy.

Judging from the literature on this subject, presented by the internist and by the surgeon, there would seem to be a wide divergence of opinion with regard to the condition and its results. Personal conversation with some authors, however, shows that, considering their viewpoint, it is not so dissimilar as appears from the emphasis placed on certain conditions and symptoms. The internist, in urging medical care, refers to the danger of surgery. In the 4532 cases of duodenal ulcer the operative mortality was but 1.76 per cent.; death naturally occurred in the more severe, long-neglected and complicated cases of obstruction, perforation or hemorrhage, while in the 1191 cases of gastric ulcer the mortality was 3.77 per cent.; but all physicians admit the greater seriousness of the latter condition. Again the internist refers to the rare bad results, largely avoidable, such as the vicious circle and gastrojejunal ulcer. It is true that some surgeons perform gastro-enterostomies because of symptoms, for example, digestive reflexes, abdom-

inal and even spinal, without positively determining the presence of the ulcer. In a number of cases, to the discredit of surgery, it is necessary to cut off and close the gastro-enterostomy which was made, although no ulcer was present, the patient being far worse than before the operation. In this manner we have dealt with a few hundred cases in which the gastro-enterostomies had been made, based on symptoms alone, since the presence of the ulcer had not been proved. Fourteen of this group of patients had been operated on in our own Clinic in the early developmental period of gastric surgery when abdominal examinations were less thorough, on the surmise that they were suffering from ulcer on the posterior wall of the stomach. The surgeon, on the other hand, appears to discredit the internist, as he never sees an ulcer in the early stage unless it has perforated or is causing hemorrhage; he thus may exaggerate the danger of ulcer. All except emergency patients are treated by many physicians for long periods before they receive the benefits of surgery, and again the surgeons frequently find that they are giving surgical intervention not for ulcer but for secondary conditions, with varying symptoms of gastric disturbance which are not caused by ulcer but are the response of the stomach in pyloric spasm induced by disease of the appendix, more commonly disease of the gall-bladder or more rarely disease of the pancreas. Although the patients may have passed years in the active care and treatment of their stomachs the gastric trouble is reflex in origin. Nevertheless the patients need surgical treatment.

In the diagnosis of gastric and duodenal ulcers much attention is paid to the history given by the patient of attacks with intervals of health. The relief obtained by taking food, fluid or alkali and the relationship in time of appearance of symptoms to the last meal are of importance. Qualitative food dyspepsia rarely is associated with ulcer but represents a gastric reflex appearing within a half-hour after food is taken, while quantitative food dyspepsia is

usually associated with interference of peristalsis which if intestinal appears at the end of one hour. Surgery is usually indicated for relief but not necessarily surgery of the stomach, for hemorrhage (vomited and by bowel) may come from gastric erosion, from the liver, the pancreas or from rupture of veins within the stomach caused by splenic disease. In about one-fifth of the cases of true ulcer hemorrhage is a symptom, but little attention is paid to occult blood except in unusual conditions. It is of interest, however, that in a large series of our early cases of gastric ulcer about one patient in four had had hemorrhage before operation and one in twelve suffered from hemorrhage afterward. This is an additional reason for destroying the ulcer, which we strongly recommend, as well as making the gastro-enterostomy, since if destruction of the ulcer alone is sufficient to cure, natural perforation and its healing should theoretically cure. Perforation, while not common, does occur, without relieving symptoms, however, and unless it occurs as a primary symptom it is not so serious as is generally believed, since Nature usually affords protection by immediate stasis and adhesions.

Great reliance is placed in the *x*-ray to corroborate the clinical history and general diagnosis of the condition. Carman and his co-workers in the Clinic who have wide experience in such cases are able to make the diagnosis from the *x*-ray standpoint in 95 per cent. The importance of the *x*-ray is very great in determining whether the ulcer is gastric or duodenal, which is often difficult or impossible clinically.

We believe with Sippy that control of the acids limits peptic activity and gives relief of symptoms, but we also agree with Moynihan that treatment but tides the patient through the exacerbation and does not cure permanently. One or two years between attacks without treatment is a common early history. A gastro-enterostomy, however, permanently applies the medical principle of treatment by

overcoming the effects of pyloric spasm, preventing retention of gastric secretion after food has left the stomach, and by allowing sufficient quantities of the alkaline secretion of the duodenum to pass into the stomach to lower the general acids. This fact was first called to our attention by Paterson. Lemon, in a series of 200 cases in our Clinic, showed the reduction in general acids after operation to be 39 per cent. and in free hydrochloric acid 46 per cent. The change in the local environment apparently often permits Nature to heal the ulcer as well as to overcome symptoms. The retention of a considerable amount of secreted acids in a stomach free of food indicates a pyloric spasm and a varying loss of balance between the neutralizing alkalies in the first portion of the duodenum and the acids of the stomach and herein lies the defect of pyloric operation for ulcer, effective as it may be for spasm; for a time it relieves by removing the control of the gastric outlet, but the acidity is not changed. A high proportion of combined acids as compared with the amount of free acid indicates delay or retention caused by spasm or obstruction. In gastric ulcer the marked lowering or loss of free acid and increase of combined acids may indicate malignant change, although it is admitted that cancer of the stomach occasionally occurs with a high acidity. The same change in acids, lowering of free acid and increase of combined acids, is often found associated with pyloric spasm secondary to cholecystitis and pancreatitis. Achylorhydria is seldom changed by medication or surgical intervention; certainly gastro-enterostomy is not indicated. Do all cases of ulcer require operation? In some instances in a routine general examination ulcer of the duodenum is found without appreciable symptoms. Frequently we do not operate in such cases, but we inform the patient of his condition, direct him to live with greater care, and advise him that operation will be necessary if certain symptoms arise or if the routine of life is deranged by such special care. In the earlier stages

of duodenal ulcer destruction by cautery and closure is effective at least for a time. A number of such cases have been observed in the Clinic. In ulcer of the stomach with low acidity this procedure may be successful, but with high acidity and greater spasm gastro-enterostomy is indicated even after excision or destruction of the ulcer. I believe that the excision or destruction of ulcer of the stomach, even if it gives but few symptoms, is indicated regardless of the degree of acidity. Should gastro-enterostomy always be made after destruction or removal of ulcer of the stomach? In some cases, in which the symptoms are only occasional and of short duration, with long intervals of health, the closure of an acute perforation is all that is required, as in them the acids are low.

In a study of the results of 647 operations performed in the Clinic on 638 patients with calloused ulcer of the stomach from July 1, 1914, to July 1, 1919, the average mortality was 3.2 per cent., more than double the average mortality in 2734 operations performed in the same period on 2720 patients with duodenal ulcer. Five hundred and thirty-four ulcers were located on or around the lesser curvature, 85 on the posterior wall, 9 on the greater curvature and 5 on the anterior wall; the location of 5 was not definitely recorded. Of those on the posterior wall 8.2 per cent. were in the pyloric third, 73.8 per cent. in the middle third and 16.5 per cent. in the cardiac end. All were of the chronic perforating variety and 53 were attached to the pancreas and involved it in the ulcerative process. Fifty-seven of the 85 patients were males and 28 were females; their ages varied from eighteen to sixty-nine years; the average was about forty-four years; the average duration of symptoms was six and one-half years.[10] Investigations for many years at the Clinic have led us to reiterate the assertion that gastric ulcer is potentially malignant, although by a postmortem examination of extensive disease causing death it may be impossible to determine that an early ulcer was present.

Many ulcers that we believe to be benign and excised showed the presence of carcinoma in a limited area of the margin. We believe that Aschoff is correct in his assertion that if the lesion is cancer originally the base of the ulcer will prove to be cancer, but in a few cases the cancerous area was in the margin only, and we therefore believe cancer often develops on ulcer and hyposensitive stomachs obscure early symptoms.[14]

Balfour, on the theory that malignant cells are much more vulnerable to heat than normal cells, suggested and developed a slow destruction of ulcer by perforation with the cautery and immediate closure and gastro-enterostomy (Fig. 1).

In the removal of perforating ulcers of the posterior wall of the stomach attached to the pancreas we use the upper approach through the gastrohepatic omentum. The finger is hooked around the attached ulcer area and the ulcer shaved from the pancreas, its margins are cut away with a knife or cautery and the opening closed with chromic catgut sutures. To protect and mobilize this area of the stomach a gastrocolic omental opening is made between the stomach and the colon and the margin of the duodenum is drawn through the opening and plastered over the posterior wall of the stomach, to which it is fixed by sutures, covering the area from which the ulcer was excised as well as the pancreas. A posterior gastro-enterostomy is also made (W. J. Mayo).

In 89 operations performed in the Clinic for hour-glass stomach the operative mortality was 7.4 per cent. Of the various methods of excision and plastic enlargement of the stomach for the relief of this most distressing condition the sleeve resection of the central portion of the stomach, usually with gastro-enterostomy, is performed. If there is a recurrence we remove the lower half at the second operation, uniting the narrowed proximal portion to the jejunum and sometimes to the duodenum. As a rule we also make the

same type of union of the stomach with the duodenal end or the jejunum for extensive ulceration and thickening, and for local cancer in the pyloric region after resection of the stomach. I first saw the end-to-side union of the stomach and the jejunum in 1912 in Germany and in Austria, where it was called by some the Hofmeister operation and by others the Enderlin. Later we found it had been described by Polya in 1911. I performed 5 of the operations in 1913. After division of the stomach the proximal end was drawn through an opening in the mesentery of the transverse colon to which it was sutured and the jejunum applied to the whole of the cut area of the stomach, a large opening being made and the duodenal division being closed by suture. In some cases this operation gave trouble from traction of the transverse colon on the stomach, and when the operation was performed for cancer the rich blood supply of the mesentery, if recurrence occurred, caused early obstruction. Balfour obtained a higher percentage of good results by making the same attachment of the jejunum anterior to the colon, and we have adopted this method and found it very satisfactory. In large openings in the end of the stomach I have found additional advantage in partial closure and covering the closed portion with the unopened jejunum by suture. By turning the jejunum to the right a loop of from twelve to fourteen inches is sufficient to provide for the drop of the colon; the jejunum, passing around to the left of the sagging, transverse colon and come out of its splenic flexure receives no pressure from the colon (isoperistaltic attachment). The surgeon must watch that the first loop or coil of jejunum is not left turned under the attached second loop to cause obstruction. Surgeons who do not turn the bowel also have good results.

Gastrojejunal ulcer is an unfortunate condition which occurs in a small percentage of patients who have been primarily relieved by gastro-enterostomy, but their troubles are so continuous or the recurrence of spells so frequent

after some months of apparent cure, and they consult so many physicians, that each case apparently stands for a multitude of failures. Such cases do much to discredit the surgical treatment of ulcer, since contraction closes the gastro-enterostomy ultimately and possibly the bowel; and many physicians still believe natural closure to be the ultimate fate of gastro-enterostomies, although in truth it is a rare condition. But even the present small percentage of gastrojejunal ulcers can be markedly reduced, I believe, by avoiding the use of permanent suture material for the brief period demanded in the ordinary case of gastro-enterostomy; undoubtedly it can be lowered still further if more attention is paid to freeing patients of their foci of chronic infection, usually streptococcic, which give the opportunity for new infarctions at the point of gastrojejunal union, often commencing before healing is completed. We admit that silk sutures hang for long periods in the majority of cases without causing ulcer (Fig. 2).

To January 1, 1920, we had operated on 83 patients with gastrojejunal ulcer, of which 47 followed gastro-enterostomies performed in the Clinic for benign duodenal or gastric ulcer and 36 followed primary operations elsewhere.[6] In a number of this group the permanent silk suture was found hanging in the ulcer's indurated area and in others it had apparently but recently passed out; in 4 instances the sutures have been found hanging from the ulcer area and exposed to the gastric fluids four years following the operation, and in a larger number of cases the same condition has been found after shorter periods following operation. In such cases the patient complains much as before the operation and the trouble is more continuous.

The roentgenogram gives valuable aid in the diagnosis of gastrojejunal ulcer in about 80 per cent. of cases. In 3 instances we have seen such ulceration perforate the colon and produce a gastrojejunal-colic fistula. If the ulcer area is small its excision is advisable and the opening should be

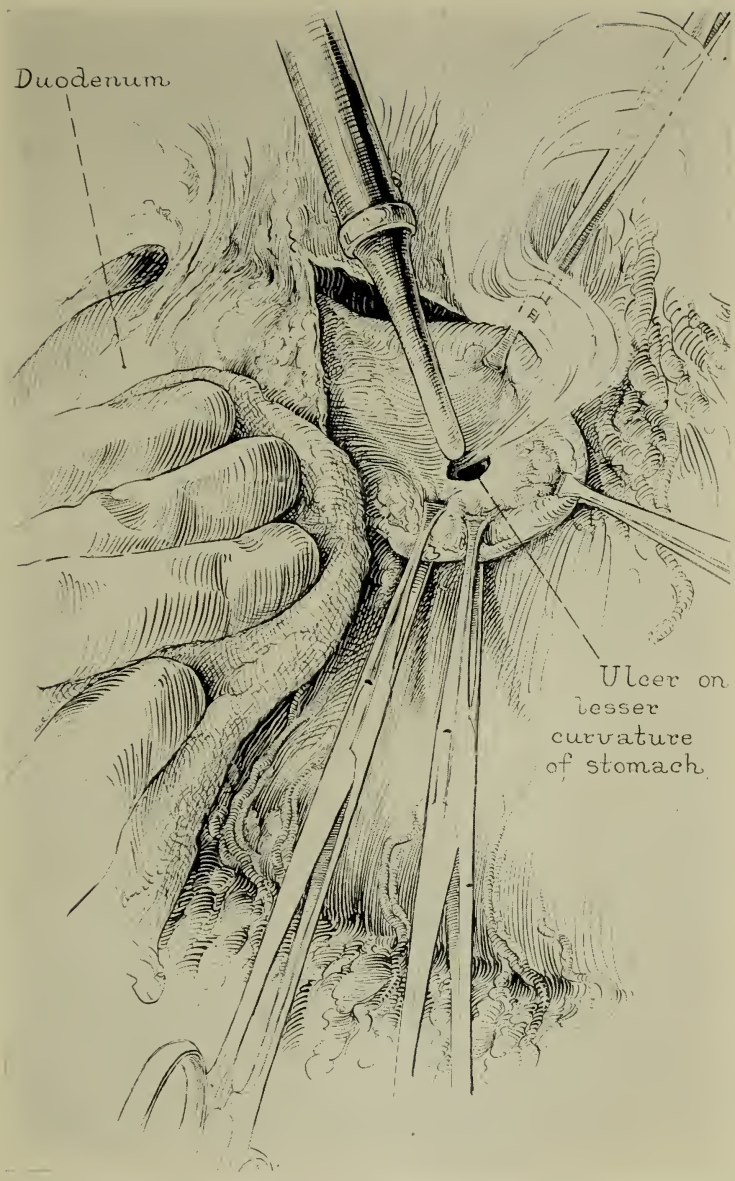

Fig. 1—Destruction by cautery (Balfour method) of ulcer on the lesser curvature of the stomach.

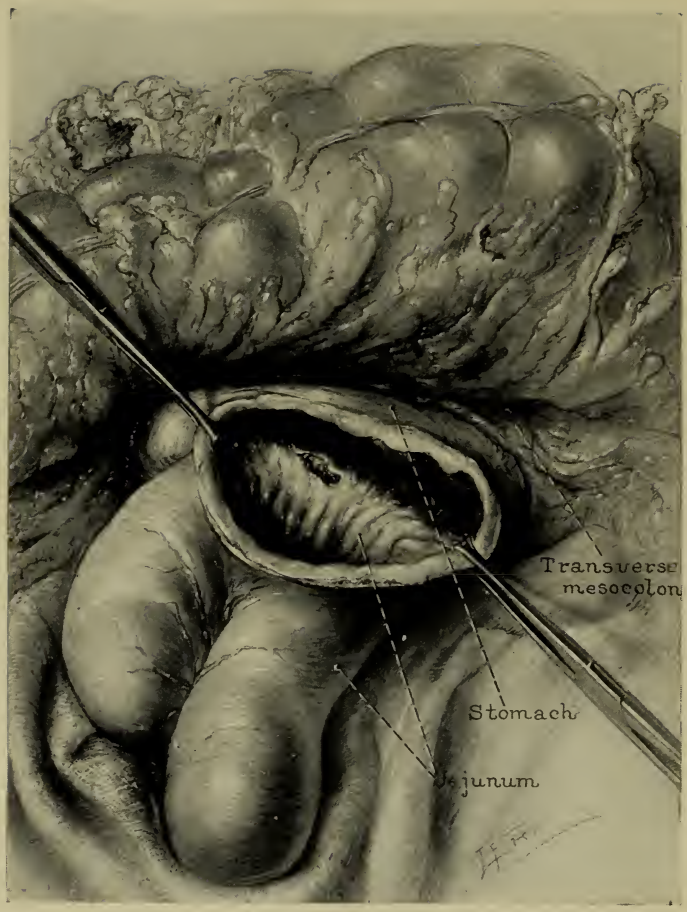

Fig. 2.—Gastrojejunal ulcer on the suture line at the site of an old gastro-enterostomy.

re-established by catgut suture. In extensive areas of ulceration and partial closure the gastro-enterostomy is undone and the bowel and the stomach closed; in a few cases it has been found advisable to enlarge the pyloric outlet by some of the plastic methods.

Gastric ulcers should receive special consideration because of the seriousness of perforation, the chronic symptoms, the frequent deformity and fixation of the stomach, the not infrequent development of carcinoma, and because the results following gastro-enterostomy for gastric ulcer are certainly not so good as those following gastro-enterostomy for duodenal ulcer. Graham in an investigation of 438 cases of duodenal ulcer found that 70 per cent. of the patients who survived operation considered themselves well following gastro-enterostomy, 27 per cent. were improved and 3 per cent. unimproved.

The future condition and length of life of patients with peptic ulcer are problems recognized by insurance companies in considering the applications for insurance of those who have had operations for ulcer. Hunter, Actuary of the New York Life Insurance Company, in an investigation at the Clinic of the results of operation in a large series of cases of gastric and duodenal ulcers, found that the average death-rate for the four-year period after operation in patients with gastric ulcers was slightly more than three times the normal, while in patients with duodenal ulcers it was, if anything, slightly less than normal. The series consisted of 2431 patients, and all but 108 were traced.

Conclusions. If it is true that there is an average duration of a number of years in the majority of cases of duodenal and gastric ulcers, many extending from twenty to thirty years, it is probable that there is an exaggerated idea of their danger to life. Acute perforation is a serious danger which is greater when it occurs as a primary symptom of ulcer. Subacute and chronic perforations are frequently noted at operation. Extensive hemorrhage may also cause

death. While few persons die from these conditions the number is greater than the number of those who succumb from surgical measures, which, if instituted in time, should restore the patient to health and activity. It is true that patients suffer, are disabled and should be relieved, and it is also probable that but a small percentage of the total number of ulcers are recognized or treated for the true condition. Gastric ulcers may give greater discomfort than duodenal ulcers, and because of the danger of malignant degeneration should be destroyed at the time of the operation unless this procedure would add unwarranted immediate risk. I believe patients who have gastric ulcer should be informed of this danger. While blocking the pylorus has been recommended in addition to gastro-enterostomy and practised the procedure was unnecessary and is now obsolete. In the surgical treatment of ulcer we have applied a well-known principle of agriculture: an acid and continuously wet soil is tile-drained and its surface limed.

In fact the surgical treatment of ulcer is the best recognition of the value of medical treatment in permanently overcoming delay or obstruction and lowering the acidity with the patient's own alkalies.

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ULCER OF THE JEJUNUM FOLLOWING GASTRO-ENTEROSTOMY

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Ulcer of the jejunum following gastro-enterostomy is caused by gastro-enterostomy. Even the most ardent advocates of this operation must admit the causal relation. The manner in which it produces the ulcer has been the subject of considerable discussion. A jejunal ulcer is rarely found except after gastro-enterostomy, though sometimes it occurs after diseases that destroy the efficiency of the pyloric portion of the stomach or that interfere with the normal character of the gastric or duodenal secretion. Charles W. Oviatt[1] says: "Peptic ulcer of the jejunum is rare; usually following the operation of gastro-jejunostomy. . . . It has never been reported following the operation of pyloroplasty or gastroduodenostomy for benign conditions."

Jejunal ulcer, however, has been known to occur without any previous operation. Robert C. Bryan, of Richmond, reports such an ulcer which perforated and caused death.[2] Bryan's interesting case was a man in whom there was marked disease of the stomach and duodenum, and he thinks the pathology in the stomach and duodenum prevented the proper protection of the jejunum.

W. T. Terry, of San Francisco,[3] reports operating on three

[1] American Practice of Surgery, vol. vii, p. 718.
[2] Surgery, Gynecology and Obstetrics, March, 1916, pp. 279–286.
[3] Journal Am. Med. Assn., July 24, 1920, vol. lxxv, No. 4, pp. 219–222.

cases of jejunal ulcer following gastro-enterostomy which occurred in his practice between the years of 1914 and 1918. In none of these three cases was the gastro-enterostomy opening closed and in one a recurrence of the jejunal ulcer demanded a third operation, while in another the clinical symptoms show strong probability of a recurrence of the ulcer. Such an experience in the practice of one surgeon within four years is very significant. The cases of Terry are carefully reported and he arrives at the conclusion that the chief cause of jejunal ulcer following gastro-enterostomy is the fact that the acid gastric juice is poured into the jejunum which is accustomed to alkaline contents.

While there can be no doubt that gastro-enterostomy causes ulcer of the jejunum, the manner in which it does this has been given various interpretations. It seems most probable that the theory of the ulcer being due to the dumping of the acid gastric juice into the jejunum is correct. There is no viscus of the body in which we can permanently alter the physiology by changing from a strongly alkaline to an acid medium, or vice versa, without causing derangement of function. The urinary bladder, for instance, is accustomed to urine that is acid and a change to alkaline urine for a considerable length of time produces irritation and eventually cystitis. If the acidity of the gastric juice is greatly lowered, even though the reaction may not be changed, symptoms are usually produced. It seems, then, that instead of magnifying the importance of technical errors of the operation, we can more justly regard the violation of a broad physiologic principle as the cause of jejunal ulcer. This, too, is borne out by the fact that jejunal ulcer is rarely if ever observed after pyloroplasty and that gastro-enterostomy after cicatricial obstruction of the pylorus invariably gives the best results. Thus, Balfour[4] says, "The best results after gastro-enterostomy occur when there is stenosis of the pylorus."

[4] Surgery, Gynecology and Obstetrics, June, 1917, vol. xxiv, p. 731.

This clinical observation can be explained by the fact that in cicatricial stenosis of the pylorus no gastric juice enters the duodenum through the pylorus, but the stomach contents are emptied entirely through the gastro-enterostomy stoma. Before the gastro-enterostomy was done the powerful contractions of the stomach would force a meager amount of gastric contents through the stenosed pylorus, but after the gastro-enterostomy the stomach can empty itself easily without the necessity of such strong contractions. Consequently, the stenosis becomes complete when not subjected to the pressure from strong peristalsis. Such pressure is impossible when there is a leak at the gastro-enterostomy opening. This complete stenosis prevents the lowering of the alkalinity of the duodenal contents by the passage of gastric juice through the pylorus, so the duodenal secretion is delivered at the stoma of the gastro-enterostomy with its maximum alkalinity, and can readily neutralize the acidity of the gastric juice and protect the jejunum from the deleterious effects of the acid. This result is not obtained by a temporary closure of the pylorus because, as is well known, it is difficult or impossible to occlude the pylorus artificially. When the pylorus opens after an infolding or a ligature, the acid gastric juice again enters the duodenum, lowers the alkalinity of the duodenal contents, and so prevents the protection of the jejunal mucosa at the stoma of the gastro-enterostomy.

Naturally, alteration of the gastric juice in which the acidity is increased or diminished, or change in the duodenal secretion will have a pronounced effect. It is possible to imagine a condition in which the alkalinity of the duodenal contents is so low that it cannot overcome the acidity of the gastric juice until the jejunum is reached. This may account for those rare cases of ulcer of the jejunum that do not follow gastro-enterostomy, as reported by Bryan.

The frequency of ulcers in the pyloric end of the stomach and in the adjacent duodenum has not been fully explained.

The excellent work by T. B. Reeves, of the Mayo Clinic, on the blood supply of the stomach and duodenum in relation to ulcer throws some light upon this subject.[5] Reeves shows that the anatomic arrangement of the arteries along the lesser curvature of the stomach and throughout the first inch of the duodenum predisposes to thrombosis and renders these vessels very likely to be occluded by emboli. Undoubtedly, the chief direct cause of ulcers of the stomach and duodenum is sepsis which probably comes, as Rosenow has so frequently demonstrated, from hematogenous infection with streptococci. It is highly probable that for every gastric or duodenal ulcer that persists for months or years, there are very many other lesions in this region that heal readily. It is also probable that at the time of the origin of the ulcer, the hematogenous infection produced irritation or inflammation in the gall-bladder, appendix, pancreas, kidneys and other organs. These viscera usually recover and may completely throw off the evidence of infection. If the gastric or duodenal ulcer persists, it may erroneously be regarded as having been the sole lesion when in all probability it is merely a survival of multiple lesions.

In ulcer of the jejunum the etiology appears to be different. We are not surprised at the erosions which a gastric fistula, for instance, causes on the skin, because the skin has but little natural resistance against the acid gastric juice. A fecal fistula high up in the small intestine also produces ulceration on a cutaneous surface. This happens because nature has not prepared the skin for constant contact with these body juices which in their normal surroundings produce no reaction. Why, then, should we marvel when the normal jejunum, accustomed to an alkaline medium, protests against the acid gastric juice, any more than when ulcers are produced on normal skin by the constant flowing over it of either gastric juice or *succus entericus*?

[5] Surgery, Gynecology and Obstetrics, 1920, vol. xxxiii, pp. 374–385.

The lesser causes of jejunal ulcer are too greatly emphasized. Non-absorbable sutures undoubtedly predispose to ulceration at the site of a gastro-enterostomy. The use of clamps or any unusual trauma, the turning in of too much tissue and interference with the blood supply, are all direct causes of jejunal ulcer, but even when all these things are eliminated, jejunal ulcer still follows gastro-enterostomy, though in a smaller proportion of cases.

If we had a patient with a large scar on the leg, we know that the slightest trauma to this scar will result in slow healing. A scratch that elsewhere in the body may be repaired perfectly will often on such a scar produce an ugly ulcer. Infection is difficult to overcome in such tissue. It is true that the immediate trauma over this scar is the direct cause of the ulcer, but we should not disregard the fact that such a trauma elsewhere would not produce an ulcer. The use of clamps, and of linen or silk sutures, and even slight interference with the blood supply, elsewhere in the gastro-intestinal tract rarely give rise to symptoms. Though the pyloroplasty of Finney is done with silk, and though intestinal sutures are usually of silk or linen, we do not hear of non-absorbable sutures or the use of clamps in these regions causing ulcers or bad results. The probable explanation is that the changed physiology in the jejunum caused by the gastro-enterostomy weakens the resistance of its tissues and that traumas or non-absorbable sutures that are easily taken care of elsewhere cannot be borne here.

A jejunal ulcer often occurs around the margin of the gastro-enterostomy opening. This, probably, is because the mucosa of the jejunum nearest this opening is least protected from the effects of the gastric juice. Its resistance is, therefore, lower and the trauma or the suturing, particularly if there is the added insult of non-absorbable sutures, causes the ulcer. It is interesting, however, to find that in none of Terry's three "cases were any retained sutures found, although search was made for them."

The ulceration may occur, however, where the current of gastric juice strikes the wall of the jejunum opposite the stoma. In such ulcers in a region where the blood supply of the jejunum is unimpaired in any way, it seems that no other interpretation can be put upon the cause of the ulcer than that it is due to the effect of the gastric juice. In the following case the ulcer occurred in this location.

Case. The patient, B. V., white, male, aged forty-one years, entered the Hospital on May 27, 1914, suffering on the right side of the abdomen with severe pain which came on suddenly. The pain seemed chiefly over the right iliac fossa. A muscle splitting operation over the appendix showed it somewhat inflamed though not sufficiently inflamed to account for the severe pain. The appendix was removed, and an incision was made over the gall-bladder region. A duodenal ulcer was found, which had perforated to the peritoneum and was plastered over with the gall-bladder. The ulcer was folded in and a posterior gastro-enterostomy was done without clamps. The patient did well for a few months, and then began suffering from hunger pains and abdominal discomfort. An operation on August 8, 1916, showed many adhesions about the pylorus and gall-bladder, with a marked scar at the site of the duodenal ulcer. The gastro-enterostomy opening which had contracted considerably, was enlarged, using chromic catgut for sutures. For about two years the patient did very well. Then he had hunger pains and general abdominal discomfort. After clinical examination by Drs. Call and Porter and roentgenographic examination by Dr. Fred Hodges, a diagnosis of jejunal ulcer was made. A third operation was done on January 30, 1920. The gastro-enterostomy was disconnected and the stomach opening was closed. A perforating ulcer was found in the jejunum on the mesenteric border. It had opened into the mesentery of the jejunum. The ulcer was about one-half inch in diameter and was opposite the stoma of the gastro-enterostomy opening. The affected portion of the jejunum

which contained the ulcer was resected and united by the end-to-end method. The new pyloroplasty was done. At the site of the old ulcer there was considerable scar tissue, most of which was excised. The gall-bladder was very thick and adherent, but contained no stones. It was not removed. The patient suffered some pain shortly after the operation. This pain was occasionally better, but recurred at intervals, and was quite severe. It was partially relieved by food and alkalies. A roentgenographic examination showed marked retention in the stomach, with many adhesions around the pylorus and duodenum, and the possibility of an ulcer. The patient was again operated upon on December 6, 1920, and the gall-bladder was found thick and universally adherent. There was an ulcer just to the gastric side of the pylorus, on the lesser border of the stomach. This had perforated into the gastro-hepatic omentum and formed a little cavity about one-half inch in diameter. The anterior wall of this cavity was formed by the adherent gall-bladder. The gall-bladder was removed in the usual way. The margins of the ulcer were disinfected with the cautery and the ulcer was excised. The cavity was disinfected with a piece of gauze soaked in pure carbolic, and its walls were carefully dissected away. The tissues were mobilized and the cavity was closed. The opening of the ulcer was enlarged by a short incision into the stomach, inward and slightly downward. The wound was closed by interrupted sutures of tanned catgut for the mucosa and two layers of continuous linen sutures. The patient made a satisfactory operative recovery.

A recurrence of this ulcer just on the gastric side of the pylorus was probably due to the fact that closure of the gastro-enterostomy opening suddenly switched all of the gastric juice over tissue that had poor resistance because of the scar tissue from the previous infiltrating ulcer, and a subsequent pyloroplasty while the diseased gall-bladder which was markedly adherent at previous operations still remained as a focus of infection.

If, then, the physiology of the jejunum is so upset by gastro-enterostomy, why is gastro-enterostomy generally considered a satisfactory operation in duodenal or gastric ulcer? If any considerable number of gastro-enterostomies for gastric or jejunal ulcer with an open pylorus are followed up, the results will usually be found far from satisfactory. If the ulcer is the chief or the sole surviving lesion, we have a right to expect a permanent and complete cure in most cases. That this is not true, however, can be testified by many internists, whom the patients with gastro-enterostomies are more prone to consult than the surgeon. Thus, Frank Smithies, who was formerly gastro-enterologist at the Mayo Clinic and is now at the Augustana Hospital in Chicago, has reported his observations of 273 patients on whom gastro-enterostomy was done. His paper was not intended primarily as critical of the beneficial results of gastro-enterostomy, but his statistics show that of this entire number only 20.9 per cent. of the patients were clinically complaint-free, while 28, or 80 per cent. of the duodenal ulcer patients on whom gastro-enterostomy had been done had pain or distress, and many of them had other symptoms, such as gas, nausea, or vomiting[6]

These symptoms do not usually follow gastro-enterostomy at once. It is only after continual perversion of the physiology of the jejunum that nature protests. It is probable that many jejunal ulcers following gastro-enterostomy never come to operation, and it is even more probable that for every patient who has a jejunal ulcer, there are several others who have hyperemia or irritation of the jejunum causing marked symptoms. In this way, then, we can account for the late results in Smithies' report, showing only 20.9 per cent. of the patients complaint-free after gastro-enterostomy. Doubtless some patients with unusual resistance can overcome the unphysiologic handicap of a gastro-enterostomy and in this way

[6] Surg., Gynec. and Obstet., March, 1918, vol. xxvi, pp. 275–277.

we may account for the 20.9 per cent. who remained complaint-free after gastro-enterostomy. All of us know patients who go through life with many handicaps and without complaint, whereas the same conditions in others will produce pronounced symptoms. This fact, however, should not justify unphysiologic surgical procedures.

That there is a distinct field for gastro-enterostomy is obvious. (1) When there is cicatricial stenosis of the pylorus and duodenum so marked that the duodenum cannot be returned to normal and no bleeding, gastro-enterostomy gives excellent results for the reasons already explained. (2) When there is a sub-acute perforation of the duodenum with such extensive leukocytic infiltration that its walls will not hold sutures, eventually stenosis is almost certain to occur. Here the tissues will not hold sutures and pyloroplasty should not be done. (3) In obstruction of the pylorus from malignant growths, gastro-enterostomy is, of course, the proper operation.

In most of the other cases whether the ulcer is located in the body of the stomach or elsewhere, or where pyloric stenosis is confined to a narrow band of tissue, pyloroplasty is indicated. Occasionally the location of the ulcer demands a pylorectomy. When the ulcer is in the duodenum and is an inch or more from the pylorus, excision of the ulcer transversely and suturing the wound in this direction, as practised by Judd, gives excellent results. In such a location the ulcer may be treated without reference to the stomach or pylorus.

W. J. Mayo says that, when operating for gastro-jejunal ulcer,[7] "We now cut off the gastro-jejunostomy, close the stomach and jejunum and make a pyloroplasty after the method of Finney." Apparently this procedure has given satisfactory results in his hands, whereas in two of the three cases reported by Terry, there appeared to be a recurrence of the jejunal ulcer when the gastro-enterostomy opening

[7] Jour. Am. Med. Assn., July 24, 1920, vol. lxxv, No. 4, p. 221.

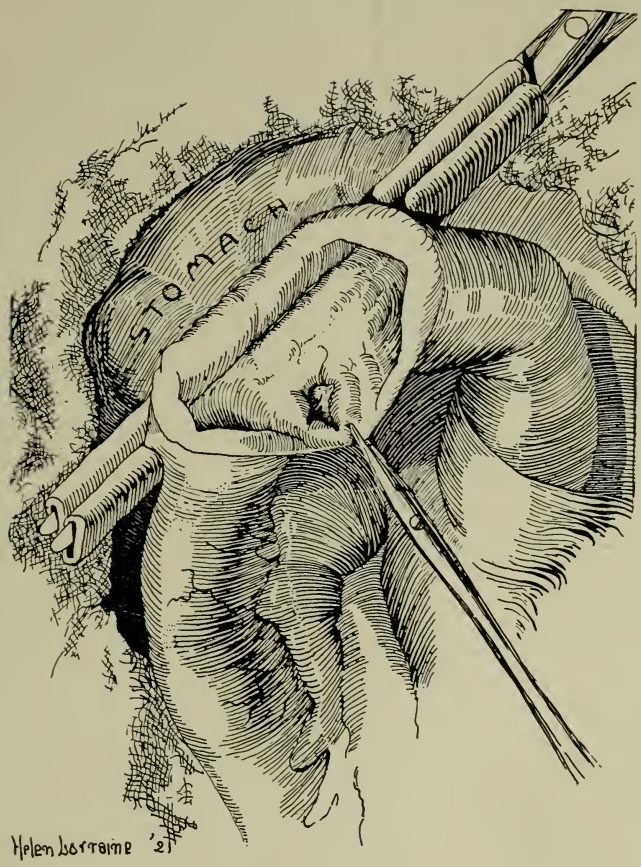

Fig. 1.—Location of the jejunal ulcer in patient, B. V. The ulcer is about opposite the opening into the stomach and has penetrated into the mesentery of the jejunum.

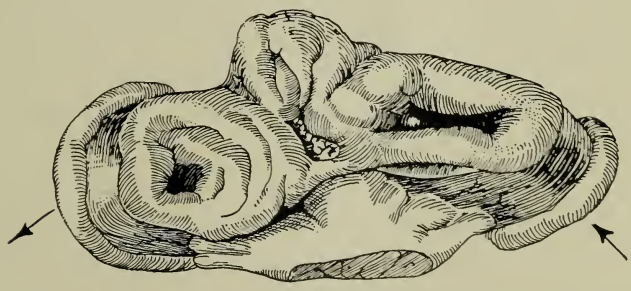

Fig. 2.—Specimen containing jejunal ulcer after resection of the jejunum (Patient B. V.).

Fig. 3.—Mr. M. L. S. Constant prepyloric filling defect (ulcer) shown at arrow. Tracing from roentgenogram taken a few days before pyloroplasty which was done May 6, 1919.

Fig. 4.—Mr. M. L. S. Tracing from roentgenogram taken November 25, 1920. Note the excellent pyloric sphincter and duodenal cap. There is no filling defect. The patient is complaint-free.

Fig. 5.—Miss E. D. H. Tracing from roentgenogram taken shortly before pyloroplasty, which was done July 3, 1918. Arrows show the constant filling defect in the duodenal cap, where there was a duodenal ulcer.

Fig. 6.—Miss E. D. H. Tracing from roentgenogram taken November 16, 1918, which shows a perfect duodenal cap. Roentgenogram taken December 5, 1920, shows virtually the same picture. The patient is complaint-free. The pylorus seems merely a little wider than it was before the pyloroplasty.

was not closed. It seems logical to conclude that if a pyloroplasty is the proper procedure for the cure of a jejunal ulcer following gastro-enterostomy, the pyloroplasty in the first instance would have been excellent prophylactic treatment for jejunal ulcer.

Elsewhere I have reported a new pyloroplasty[8] which seems to have the advantages of simplicity and of restoration of tissues to their physiologic normal. It should be remembered, however, that the origin of a gastric or duodenal ulcer is probably from hematogenous infection and the ulcer is frequently accompanied by other lesions, such as cholecystitis, which produce adhesions. It is even more necessary in pyloroplasty to remove a diseased gall-bladder or to prevent the formation of firm adhesions then it is after gastro-enterostomy, because the normal peristalsis in the region of the pylorus will cause a tugging on adhesions that will produce pain; whereas in gastro-enterostomy the necessity for even normal peristalsis at the pylorus is diminished and the tugging on these adhesions is reduced to a minimum. It must be emphasized, then, that in doing a pyloroplasty a diseased and adherent gall-bladder should be removed, but with as little trauma as possible, and the raw surfaces and the tube to the cystic duct should be fully covered with fat and omentum. The patient also should lie chiefly on his left side for several days after the operation to prevent the duodenum being drawn up to the liver.

Since the first publication on this pyloroplasty, in which eleven cases were reported, a few changes have been made in the technic. Instead of a single suture approximating the two ends of the incision, a second suture is placed not more than one-half inch above this. These two sutures, when tied at the same time and held up, bring the anterior wall of the pylorus away from the posterior wall and at the same time make suturing of the wound in the duodenum easier

[8] Jour. Am. Med. Assn., August 23, 1919, vol. lxxiii, pp. 575–582.

than if only one suture was placed or if the second suture was placed farther up. The second change in technic is that the second row of sutures merely approximates the cut edges of the peritoneal and muscular coats. Formerly an effort was made to invert tissue with this row. If this was done, the third row of sutures, also inverting tissue, caused too much of a lump. By merely approximating the cut edges with the second row, as in suturing the skin, and inverting the tissues with the third row of sutures, but little of the edges of the incision is turned in and a smoother wound results. A mattress suture of fine tanned catgut is placed at the point of greatest tension after the three rows have been inserted, and with the long ends of this the omentum is brought up over the suture line. It should also be emphasized that the teats of tissue at the two ends of the incision after the completion of the second row of sutures should be well turned in by beginning the third row of sutures a long distance from the teat and inverting a considerable quantity of the tissue. The suture then comes nearer the edges of the wound at its middle and again diverges at the upper extremity, turning in a large amount of tissue here.

I have done twenty-four of these pyloroplasties since the first one in April, 1918. During this time I have done four gastro-enterostomies, one operation of Judd for duodenal ulcer an inch and a half from the pylorus, and two pylorectomies. All of these operations were for ulcer except two of the gastro-enterostomies, which were for cancer. I believe this represents about the correct proportion of pyloroplasties to gastro-enterostomies. Of the twenty-four pyloroplasties, three deaths occurred in the first twelve cases. Two of these deaths have been fully discussed in the original communication, and the third death, which was the twelfth case, resulted from uremia. It was thought that the ulcer was the focus of infection for the nephritis the patient had. He died of uremia five days after the operation. Postmortem showed the stomach and pylorus in excellent condi-

tion. Probably none of these deaths would occur at present. There were no deaths in the last half of the series. For the first few months after a pyloroplasty, the results are quite similar to those after gastro-enterostomy. It is only as the length of time after the operation increases that the advantages of the pyloroplasty begin to appear.

PYLOROSPASM IN ADULTS: ITS MEDICAL AND SURGICAL TREATMENT

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Spasmodic contraction of the pylorus, or pylorospasm, while not a common complaint, is observed with such comparative frequence, that much interest has been aroused as to its clinical significance. The etiology of this affection is, however, frequently obscure and, in consequence, a number of theories have been suggested in explanation of its occurrence. It may, therefore, not be out of place to consider briefly certain factors having an etiological bearing on this condition.

Through the researches of Langley, Meyer, Gaskell and others, it has been shown that the involuntary nervous system supplies two sets of nerve fibers to every organ, the one functioning as activator and the other as inhibitor nerves, the two combined exhibiting a regulating mechanism controlling the interactivity of both groups. In the first set we have the autonomic system, as exemplified in the vagus group, the stimulation of which results in the production of pylorospasm. In the second set we have the inhibitory fibers as found in the sympathetic system, stimulation of which inhibits spasm. The evidence pointing to the presence of this opposing nerve influence can be easily demonstrated in rabbits, in whom pylorospasm can be

experimentally induced by stimulation of the vagus and inhibited by stimulation of the splanchnics. According to Rogers, the same phenomenon may be brought about even in a more prolonged and graphic manner, by subcutaneous injection of certain extracts of the thyroid, parathyroids or pyloric mucosa into dogs. He was thus able to produce a marked increase both in the flow of the gastric secretion and in gastric motility, which could be inhibited by means of an injection of atropine. Not only will atropine inhibit this reaction, but a similar effect can be brought about by the injection of an extract of the adrenal glands. He explains the latter reaction as due to a stimulation of the sympathetic by the extract of this gland. According to Rogers, "If the experimented animal is angered or excited, which is akin to worry in the human being, the gastric juice ceases to flow, due to the inhibitory influences carried to the stomach along the sympathetic. After a prolonged stimulation, the sympathetic becomes partially or fully fatigued, allowing the vagus full play free of inhibition, in consequence of which hyperacidity, hypermotility, or pylorospasm is produced, which may be followed, if this condition is much prolonged, even by ulceration." The cause of pylorospasm, therefore, according to Rogers, is a continuation of the original failure of the sympathetic, and it is suggested by him that this condition may be best relieved by means of pyloroplasty.

The researches of Cannon are of especial interest in this connection. According to this investigator, the presence of free hydrochloric acid in the stomach occasions the relaxation of the pyloric sphincter, causing the pylorus to open and thus permit the escape of the acid chyme into the duodenum. The presence of the acid in the duodenum produces a reflex stimulation of the pylorus, which closes and remains so until the contents of the duodenum have again become alkaline. This orderly escape of the gastric contents into the bowel proceeds until the chyme has been entirely

emptied into the intestine. According to this theory, whenever this orderly relationship between the stomach and the intestine is interfered with, whether by nervous or organic conditions, the pylorus ceases to relax and so empty its usual portion of contents into the duodenum and, in consequence, pylorospasm is produced. The theory of Cannon fails to explain such facts as the emptying of the stomach in achylia gastrica, and the rapid exit of water from the stomach. It has been pointed out by means of *x*-ray examinations that the very first portion of the food ingested in the fasting state may quickly empty itself out of the stomach, at which period the acidity could not have been developed sufficiently to act as a relaxing stimulation. It has been suggested by Lockhart, Phillips and Carson that certain motor activities of the stomach are associated with the relaxation of the pylorus. Marked motor activities, either in the form of changes of tone or peristalsis, may lead to the relaxation of the pyloric sphincter, explaining according to this theory, the rapid exit of water from the stomach in the neutral state; and emptying in achylia gastrica. According to Lockhardt, Phillips and Carson, therefore, there is a far more intimate relationship between the muscular activity and the relaxation of the pylorus than between the latter and the chemical reaction of the gastric contents.

McClure and Reynolds have also recently pointed out in an elaborate set of experiments, that the acid control of the pylorus is of minor importance inasmuch as contraction of its sphincter could not be produced by introduction of acid into the duodenum. However, according to their observations, the quiescent pyloric sphincter is found contracted when food is in the stomach, and opens regularly at the approach of each antral peristaltic wave.

Pylorospasm may exist in various types; the neurotic, the irritative and the reflex. As a pure neurosis, pylorospasm is rather uncommon, occurring according to our experience in but a small percentage of all gastric affections. In a large

percentage of cases pylorospasm is secondary to some irritation in the stomach itself, or appears as a reflex condition due to disease of some other organ. That there are cases of pylorospasm which are purely neurotic in origin, however, there can be but little doubt. Instances of this form have been observed in infants.

In the case of a female, aged twenty-six years, observed by us, in whom all of the symptoms of pylorospasm were manifested, and who was finally subjected to operation, no pathological condition was observed, yet entire relief was afforded by means of a pyloroplasty. The purely neurotic form of pylorospasm occurs more frequently in females than in males. In our series three females were affected to one male. As has already been noted, while pylorospasm does not occur frequently as a pure neurosis, it is quite commonly observed secondary to some gastric or abdominal affection; as in gastric or duodenal ulcer, cancer of the pylorus, enteroptosis, gall-bladder disease, appendicitis, renal disorders and diseases of the male and female genito-urinary organs.

The fact that pylorospasm may result reflexly from disease of the organs beyond the stomach, is clearly revealed in the gastric upsets which occur so frequently as a result of acute appendicitis or nephritic colic. A graphic demonstration of this fact has been noted by Aaron; by pressure on McBurney's point, he was able in some instances of chronic appendicitis to produce gastric pain, and by means of the fluoroscope he was able to note spasm of the pylorus at the same time. In fact, pylorospasm can now be clearly revealed, as will be noted later on, by means of roentgen-ray examinations.

The symptoms of pylorospasm vary in intensity according to the degree of the spasm. With a moderate spasm a mild discomfort and feeling of pressure is experienced in the epigastrium. This occurs about two or three hours after meals, and is usually accompanied by acid eructations and regurgitation. The pains are of the hunger type and are

due, according to the researches of Carlson, Hamburger and others, to active contractions of the stomach. When the symptoms become more intense, the pylorus suddenly contracts spasmodically, causing severe pain which may be followed by vomiting. The pain usually manifests itself in the epigastrium, radiating from the median line often into the back. At first the spasm appears periodically, but as the disorder progresses it may become continuous and lead to a spastic contraction at the pylorus with consequent functional obstruction and retention of food. The food is vomited under these conditions, and presents all of the characteristics ordinarily observed in cases of dilatation of the stomach. Relief is afforded for a time by vomiting, the period varying from one to four days, when a similar attack again recurs. Relief is also usually obtained by emptying the stomach of its contents by means of lavage.

After a long persistence of the affection, other symptoms ordinarily observed in dilatation begin to appear, *i. e.*, emaciation, thirst, constipation. The vomiting in pylorospasm may be persistent, finally terminating in the expulsion of a watery mucus, very acid and containing at times streaks of blood. The vomiting is often explosive in character, the stomach emptying itself suddenly of large quantities of acid contents. As soon as the spasm relaxes the symptoms disappear.

On examination during the attack the pyloric area is found tender to pressure and contraction may take place near the pylorus producing a firm mass, easily detected on palpation in patients with thin abdominal walls. This gradually disappears, as the spasm relaxes. At this time the abdomen is rather contracted and the recti muscles tense. After the spasm disappears, the tenderness is less marked, and the abdomen again regains its normal appearance. The gastric contents may show a varying degree of acidity, depending largely upon the time when the secretion is removed. During the period of spasm there may

be a lowered, normal, or hyperacid content varying according to the intensity of the attack, and the time of the onset of the cramps. In the interval between the attacks the gastric contents may be normal. There is usually present, however, a hyperacidity of hypersecretion, the degree of which usually depends largely upon the duration of the affection. It is rather unusual not to be able to demonstrate hyperchlorhydria some time during the digestive period by means of fractional analysis. After long persistence of this disorder, when obstruction with stagnation has occurred, the gastric contents assume the appearance of that ordinarily observed in dilatation of the stomach.

The greatest aid is afforded in the recognition of pylorospasm through roentgenology. It is by this method that both the nervous as well as the organic forms can usually be readily determined. Aaron has called attention to the value of the fluoroscope in the diagnosis of the reflex forms, and more recently Carman to spasms of the stomach and duodenum from a roentgenologic point of view. Spasms of the pylorus may be determined either fluoroscopically or by means of a series of roentgenograms, best by a combination of both methods.

In a study of this character it is important to determine whether the lesion producing the spasm is within the stomach or beyond this organ; or again, whether or not it is of purely nervous origin.

When spasm of the pylorus is produced by an ulcer a six-hour retention is usually present, together with a definite and persistent filling defect in the stomach; though in a number of instances in our experience, the spasm and retention were the only signs pointing to ulcer. It is interesting to note that these signs may occur with ulceration in the stomach, even when situated at some distance from the pylorus. The retention so constantly observed has been attributed to various conditions; it has been ascribed to pyloric spasticity due to the hyperchlorhydria, to gastric

atony, to interference with the peristalsis due to the ulcer or possibly to a reflex pylorospasm.

Pylorospasm is frequently of reflex origin. One finds it not uncommonly associated with cholecystitis or chronic appendicitis. In this condition the bismuth meals are retained at the pylorus for some time, the spasm relaxes to a degree, and a part or all of the bismuth is finally expelled. In some instances the spasm is so persistent that it makes us suspect that we are dealing with an ulcer, but in a number of instances of this character under our care, the diagnosis of cholelithiasis or appendicitis was eventually confirmed by operation.

Cancer of the stomach is at times, although rarely, accompanied by spasm, especially is this the case in the early stages of the disease or in those instances in which there is obstruction. Ordinarily there is hypermotility with rapid evacuation of contents without spasm. There is usually present, however, a filling defect which is generally surrounded by an invasive area which interferes with motility producing an apparently dead area. It is highly important to differentiate pylorospasm due to disease in the stomach itself or duodenum, from that due to conditions outside of the stomach. Spasm due to ulcer or cancer is usually observed situated near the lesion itself, and often in the area opposite to the lesion. Its location is constant and unvarying and the spasm is definitely present throughout the entire examination, as well as at subsequent examinations. On the other hand the spasm caused by disease of remote organs is usually short in duration and intermittent in character, and not always constant. In some instances the spasm is located at the pylorus; in others at some distance from the pylorus (gastrospasm). Though usually present in the same area, it changes its aspect now and then. In these instances a six-hour retention is often found at one examination, and not at another. The differential diagnosis is not always certain, and it may be impossible in many instances

to differentiate between the two conditions. A well-established test to exclude pyloric spasm of nervous or reflex origin is furnished by means of the administration of atropine or belladonna given in full doses. Spasms produced by lesions of the stomach are not influenced by this drug. Those of nervous or reflex origin usually disappear. In this connection it is interesting to note that pylorospasm no matter what its origin may be—whether due to disturbance within the stomach itself or without—disappears under narcosis, and it is for this reason, that it frequently remains undetected at operation.

As a rule the diagnosis of pylorospasm is not difficult but to distinguish clinically those forms purely neurotic in character, from those due to intrinsic or extrinsic causes, is at times a most difficult problem. In order to arrive at a proper diagnosis, all organic conditions must be excluded. A correct conclusion may usually be obtained by noting the presence of the attacks of pain occurring two or three hours after meals, which are relieved temporarily by the ingestion of food (hunger pains); in addition a tender area is usually present in the region of the pylorus; there are symptoms of hyperacidity of intermittent stagnation; and at times a definite resistance is detected on palpation in the region of the pylorus, assuming the character of a small tumor which gradually disappears. Finally the x-ray signs are usually very distinctive, and frequently clear up the actual cause of the spasm.

In the treatment of pylorospasm it should be remembered, as has been previously noted, that this condition is frequently secondary to some other affection located either within or without the stomach itself, and that the primary disorder should, as far as possible, be overcome before treatment is directed to the spasm. The treatment of pylorospasm consists primarily in properly overcoming the underlying neurasthenia. On this account, change of scene, massage, rest, or even a rest cure may be found advisable.

The diet should be carefully regulated, all irritating food should be avoided, and the meals should be small, easily digested and given at regular intervals. In certain instances an ulcer cure with the patient in bed for two or three weeks under a Sippy diet has afforded very satisfactory results. In other instances, the administration of olive oil has been of great service. During the attack, the best results are obtained by means of hypodermic injections of morphine with atropine; for the pain codeine combined with belladonna is serviceable. Sodium bromide with chloral has been recommended in some instances; hot applications and stupes to the abdomen and a thorough lavage with plain water; permanganate of potash or nitrate of silver solution have proved serviceable at times. The drug which is most helpful in the treatment of this affection is atropine prescribed in full doses, and best administered hypodermically. This drug inhibits the vagotonic irritation and thus relieves the spasm. Stockton has recommended adrenalin hypodermically in some instances and reports remarkable relief by the use of this drug. The administration of adrenalin nucleoprotein as advised by Rogers has given relief in a number of instances under our cure.

In the intractable forms of pylorospasm which have resisted all medical treatment, the operation of pyloroplasty has furnished a means of satisfactory relief. Rogers has reported a case of pylorospasm due to gastric ulcer, which was not relieved by gastro-enterostomy, but in which cure was finally effected by means of a pyloroplasty and he suggests this operation as a relief for this condition on purely theoretical grounds. According to this observer a gastro-enterostomy whether there be a hyperacidity present or not, does not always cure the pain due to a pyloric spasm. "The explanation of its persistence or later occurrence, especially when no ulcer is present, must indicate a continuation of the functional failure of the sympathetic, which should be relieved by pyloroplasty." (Rogers.)

Our experience is entirely in accord with that of Rogers. We have been greatly impressed with the fact that these cases of pylorospasm which remain unbenefited by medical treatment should be operated on, and that pyloroplasty affords the best possible means of cure. Moreover, pain of every character in the upper abdomen should be carefully observed and studied clinically so that if operation be undertaken for any cause and no explanatory lesion be observed, the advisability of performing a pyloroplasty may be considered; provided, of course, that definite evidence of pylorospasm has been previously noted. This fact is of the utmost importance inasmuch as the spasm is extremely apt to relax under anesthesia, and the actual condition may, therefore, be entirely overlooked in the course of the operation.

Report of a Few Illustrative Cases. Case I.—Pylorospasm of nervous origin in a female of thirty-five years; relieved by means of a rest cure and lavage of the stomach. Mrs. G. B. has been affected with nervous indigestion for several years; for the past six months after a series of family worries, her nervous symptoms have become intensified. She complains of weakness, is easily exhausted, suffers with insomnia and is extremely hysterical; in addition, the gastric symptoms have become aggravated. She suffers with discomfort and pains in the stomach one to two hours after meals, vomits acid gastric contents at times; alkalies and food give temporary relief. During an attack with the appearance of the pain, one can definitely palpate the pylorus as a hard mass, which disappears in a few moments. The gastric secretion presents a total acidity of 64, free HCl 50; no retention. An *x*-ray examination reveals a marked pylorospasm, no evidence of ulcer or any other abnormality. Under a rest cure with frequent lavage and the administration of belladonna, the patient made a speedy recovery.

Case II.—Pylorospasm complicating a case of cholelithiasis in a man of fifty-four years; cholecystostomy; recovery. J. S. had been affected with gall-bladder attacks for five years; a number of these attacks were accompanied with intense colic and jaundice. During the last few months there were severe gastric symptoms present with every attack; the patient would vomit large quantities of undigested food, and at times on the following morning, food eaten the day previously; visible peristaltic movements were detected over the region of the stomach during several attacks. No abnormalities could be determined on physical examination. The gastric contents between attacks presented a total acidity of 42, free HCl 31. An *x*-ray examination revealed the stomach pulled over and held in the gall-bladder region; there was present a six-hour retention and pylorospasm. At operation numerous gall-stones were removed; the pylorus and stomach were found normal. The gall-bladder was drained, the patient made an uneventful recovery and has had no further disturbance.

Case III.—Pylorospasm caused by chronic appendicitis in a female aged twenty years; appendectomy; recovery. J. S. sought relief from recurrent attacks of abdominal pain with which she has been afflicted for from six to eight years; the attacks appeared at intervals of from four to eight weeks. The pain would come on suddenly, was accompanied by slight fever, and would usually center itself in the right lower abdomen. The pains were usually moderate, and after a few weeks, would gradually subside. Soon after the appearance of the pain, gastric symptoms would always manifest themselves, consisting of distress, gastric peristalsis, nausea and finally vomiting; the vomitus frequently containing food eaten six to eight hours previously; as soon as the stomach had completely emptied itself, the nausea and vomiting would cease and the abdominal pain subside; although the lower right abdomen remained tender

for some days afterward. Knowing the relief afforded by the vomiting, the patient has recently been able to abort certain attacks by inducing vomiting artificially by means of emetics. On physical examination, there was present every evidence of chronic appendicitis, which was verified by means of an *x*-ray examination. An appendectomy was performed which afforded permanent relief.

Case IV. Pylorospasm caused by intestinal stasis in a female aged twenty-six years. M. S. had been affected with chronic constipation for at least fifteen years. During the past two years this condition had become more aggravated so that even with drastic purges, relief was not always afforded and the patient was required to resort to enemata frequently. After the constipation had persisted for two to three days, the patient would become nauseated, which would be followed in five or six hours by vomiting, frequently of food eaten the day previously. There were present headaches, great distention in the region of the stomach, and much pain which, too, would be relieved after the stomach had been thoroughly emptied and after a good bowel movement. On physical examination of the patient, nothing abnormal was revealed between the attacks. The gastric contents presented a total acidity of 72, free HCl 54. An *x*-ray examination revealed marked cecal and colonic stasis with a maximum prolapse of the colon. By means of a thorough regulation of the bowel movements, the patient was gradually relieved of the attacks.

Case V.—Pylorospasm accompanying renal colic in a man aged thirty-eight years. Operation; recovery. F. J. had been having attacks of acute pain in his left lumbar region at varying periods for three or four years. The attacks would appear suddenly, were very intense, and were accompanied by severe gastric upsets. At the onset of the attacks there was acute pain in the left kidney region

followed shortly by nausea and pain in the region of the stomach. The pain would proceed down the left side into the bladder and penis, and within a few hours a rise in the temperature would manifest itself. The stomach would become distended, and there was severe gastric pain, nausea and vomiting. The patient frequently vomited food taken five to seven hours previously. The attacks would last six to twelve hours. They would subside under the influence of hypodermic injections of morphine. An examination of the urine following an attack revealed blood. The diagnosis of kidney colic due to stone with reflex pylorospasm was made. An *x*-ray examination revealed a kidney stone which was removed by operation. Complete relief was afforded.

Case VI.—Pylorospasm in a female, aged thirty-nine years, simulating cholelithiasis; pyloroplasty, recovery. Mrs. W. J. had been affected with acute attacks of indigestion since the birth of her last child, four years ago. The attacks were very acute and could ordinarily be traced to errors in diet though some occurred without dietary indiscretions. The first attack was definitely noted three days after labor. The attacks were all alike, though their intensity recently had become extremely severe. These attacks were characterized by intense colicky pains beginning in the epigastrium and radiating toward the right side under the shoulder blade. This was soon followed by marked nausea and severe vomiting. On two occasions food eaten six and eight hours previous to the attacks was noted in the vomitus. Hypodermatic injections of morphine were required for relief. At no time were chills or fever observed during the attacks. On physical examination of the patient, the liver was not observed to be enlarged, though there was distinct tenderness under the right costal arch. The diagnosis of probable cholelithiasis was made, but at operation the gall-bladder appeared perfectly normal; there

was present, however, even under the anesthesia, a definite spasticity of the pylorus. A pyloroplasty was done; the patient made an uneventful recovery and has had no further attacks.

Case VII.—Pylorospasm associated with appendicitis in a female aged thirty-nine years; appendectomy, no relief; pyloroplasty, recovery. Mrs. J. M. had been affected with indigestion for the past six years. There was almost constant headache, nausea, marked abdominal distention and severe constipation. At times the symptoms would become aggravated, and there would be severe pain in the region of the stomach with nausea and vomiting, the vomitus containing food eaten eight to ten hours previously. The acute symptoms would disappear in twenty-four to thirty-six hours, leaving the entire abdomen extremely tender. On physical examination between the acute attacks, the abdomen was found soft; there was a distinct epigastric tenderness and more marked tenderness in the right lower quadrant at McBurney's point with slight muscle spasm. The gastric analysis at this time revealed a marked hyperacidity, total acidity of 72, free HCl 54. An *x*-ray examination presented a rather spastic pylorus and evidence of chronic appendicitis. Appendectomy was advised and performed; the patient had moderate relief for a month, when the former symptoms began anew and became more aggravated than before. During the acute attacks the stomach was markedly distended and on one occasion, food eaten a day previously was vomited. A diagnosis of pylorospasm was made, and a pyloroplasty performed after which no further disturbance was noted.

Case VIII.—Pylorospasm associated with chronic appendicitis and intestinal adhesions with stasis in a man aged fifty-seven years; pyloroplasty; appendectomy, recovery. J. C. had been affected with digestive trouble for several

years; recently his symptoms have become aggravated. He complains of nausea and frequently of vomiting, which affords him some relief. There is also present heartburn, acid eructations, anorexia, headache and dizziness. Constipation is marked and persistent. At times these symptoms become acute, forcing the patient to bed for one to two days. During these attacks the patient has vomited food that had been eaten a day previously. On physical examination one notes a marked tenderness over McBurney's point as well as in the epigastrium; there are no other abnormalities. The gastric analysis presents a total acidity of 63, free HCl 46. An *x*-ray examination reveals a marked pylorospasm together with a chronic appendicitis and cecal adhesions and stasis; the pylorospasm was so marked that the patient was given larger doses of belladonna, another examination made a few days later revealing the identical condition. At operation the chronically inflamed appendix was removed, adhesions released and a pyloroplasty performed. The patient made an uneventful and perfect recovery.

Case IX.—Pylorospasm of a purely nervous type in a female aged twenty-five years; no lesions detected at operation; pyloroplasty, recovery. Miss E. M. consulted us for relief of a nervous indigestion with which she had been troubled for the past six months. There was present loss of flesh, weakness, loss of strength, headache, and indigestion. The patient complained of frequent nausea followed by vomiting, and at times, of vomiting of very large quantities with remains of food eaten seven to eight hours previously. The vomitus was exceedingly acid. The discomfort was temporarily relieved by food. On physical examination of the abdomen nothing abnormal was revealed. The gastric secretion presented a total acidity of 68, free HCl 46. An exploratory operation was decided on; no lesion was observed anywhere in the abdomen; the pylorus appeared normal.

On account of the persistent pylorospasm a pyloroplasty was performed. The patient made a thorough recovery, and has remained well since without recurrence of any of her former gastro-intestinal symptoms.

Case X.—Pylorospasm associated with gastric ulcer in a male aged forty-seven years; gastro-enterostomy, no relief; pyloroplasty, recovery. J. K. S. consulted us for a gastro-intestinal disturbance which has persisted for a period of four to six weeks at a time during the past ten years. Four years ago a gastro-enterostomy was performed by another surgeon for a pyloric ulcer, relief was afforded for three months, when all the former symptoms returned. There was present pain appearing two hours after meals, which was relieved by food and alkalies; nausea and vomiting were frequent, and the patient often vomited food eaten a day previously. With the attacks of pain there was often a sensation of movements passing over the abdomen. On physical examination the abdomen was found distended and peristaltic movements were observed on one occasion. An *x*-ray examination revealed a perfectly patent gastro-enterostomy opening together with a marked pylorospasm, but no filling defect. The diagnosis of pylorospasm with possible ulcer was made. At operation there was no evidence of ulceration. The pylorus was found somewhat spastic, however, and a pyloroplasty was performed; the patient made an uneventful recovery, and has had no further return of his former disturbance.

Case XI.—Pylorospasm associated with a chronic gastritis in a man aged forty-eight years; simulating carcinoma. E. J. S. had been complaining of nausea and vomiting for the past six months. There was a loss of weight of ten pounds, poor appetite; flatulence and some abdominal pain. On physical examination no masses could be detected and there was no abdominal tenderness. The gastric secretion

showed a true achylia and there was blood in the stool. The Wassermann reaction was negative, and there was a definite defect at the pylorus revealed by the *x*-ray. The question of malignancy could not be ruled out. An exploratory operation was advised at which a chronic gastritis together with a marked pylorospasm was revealed. A pyloroplasty was performed; following which entire relief was afforded.

Summary. 1. Pylorospasm is a complex nervous phenomenon, the exact etiology of which has not been satisfactorily established. Experimentally the fact has been definitely demonstrated, that pylorospasm may be produced in rabbits by stimulation of the vagus and inhibited by stimulation of the splanchnics. That there is a definite association between this condition and the endocrine system is indicated by the fact that the spasm may be brought about by injection of certain extracts of the thyroids and parathyroids and inhibited by injection of an extract of adrenals. On the other hand, there is but little question that changes in tonus or peristalsis are of great importance in the production of this phenomenon.

2. Pylorospasm may exist in one of three types; the neurotic, the irritative and the reflex forms. In the largest percentage of cases, this condition is secondary to some irritative lesion in the stomach or is reflex from disease of some other organ. Many of these cases are promptly and completely relieved by removal of the cause—chronic appendix, gall-stones, etc. There exists, however, a purely neurotic form without any demonstrable lesion.

3. The condition can usually be recognized clinically by a careful study of the case. In the majority of the cases, slight, if any, pathological changes can be demonstrated about the pylorus at operation, as the general anesthetic usually completely relaxes the pyloric spasm. In advanced cases, one may observe varying grades of hypertrophy in the pylorus and the pyloric antrum of the stomach.

4. The symptoms of pylorospasm are rather characteristic. These consist of pains of the hunger type appearing two or three hours after meals which are relieved by emptying the stomach of its contents as well as by the ingestion of food; of contractions of the stomach leading to tumor formation which disappear as the spasm relaxes; of symptoms of intermittent stagnation and hyperacidity.

5. The greatest aid afforded in the recognition of pylorospasm is by roentgenology, by means of which the nervous as well as the organic forms may usually be differentiated.

6. In the treatment of this affection, medical measures should always be given a careful trial. If it be secondary to other abdominal conditions the primary disorder should as far as possible be overcome before treatment is directed toward the spasm. The treatment consists of overcoming the primary neurasthenia. This is most satisfactorily accomplished by means of dietetic and hygienic measures. During an attack the best results are obtained by means of hypodermic injections of morphin with atropine following a thorough lavage of the stomach. The drug most useful in the treatment of this affection is atropine given in full doses. When medical measures fail to give the desired relief, pyloroplasty theoretically is the operation of choice and practically gives most satisfactory results.

DISCUSSION ON THE PAPERS OF DRS. MAYO, HORSLEY AND FINNEY

Dr. R. C. Coffey, Portland, Oregon.—These papers are so instructive and comprehensive that I am sure very little can be added to them. In years gone by most voluminous statistics have indicated that about 15 per cent. of the operations for ulcer of the stomach and duodenum were not successful. At the present time it is maintained that the most unsuccessful cases are those in which ulcers develop secondary to operation.

As to the cause of these secondary ulcers there are probably a number of causes for their development, but whatever may be the cause it is the most serious thing we have to deal with outside of the mortality itself, and it is often greater than the mortality part of it. Secondary ulcer is the most important thing we have to consider. The cause of secondary ulcer is probably much the same agent that caused the ulcer in the first place, namely, sepsis followed by the corrosive action of the acid juice of the stomach.

I believe Sippy has given us the best conception of the nature of an ulcer. Rosenow, Sippy and Paterson combined have given us the most fundamental ideas that have been presented to us on the question of the cause and rational treatment of ulcer of the stomach and duodenum.

Dr. Mayo believes a thread in the button around the jejunum is probably the cause of many cases of recurrent ulcer. That may be true, but it is also true that it is not always the cause, and there are many cases of secondary ulcer in which there is no thread found.

Here is a case, for instance, in which the operation was done in a clinic where linen is not used, in which there was a perforating jejunal ulcer through the jejunal wall opposite the gastro-enterostomy opening with the contents of the stomach pouring into the abdominal cavity. I have seen three cases of jejunal ulcer similarly located which corresponds to the first case reported by Dr. Horsley. That is the exact point where the blade of the clamp was placed across the jejunum. Most of these ulcers are marginal, and it is very likely that marginal ulcers occur here because there is a trauma which lays the foundation for the later development of the ulcer. It is not an infrequent thing to find a secondary ulcer on the inside of the stomach. Particularly is that true in cases in which the Eiselsberg exclusion operation has been done. Following 22 operations in which the Eiselsberg operation was done in my practice, 2 developed secondary gastric ulcer distal to the anastomosis. Eiselsberg himself reports that 9 per cent. of his cases developed secondary ulcer. It may be interference with the circulation has something to do with it. It is more than likely that this being the acid secreting portion of the stomach, there is stagnation of the juices at the end of the stomach which causes corrosion in this manner. This view is strengthened by the fact that apparently there is not the same tendency toward the

development of secondary ulcer following the Rodman pylorectomy for ulcer, in which a large part of the acid-producing area has been removed.

Dr. John B. Deaver, Philadelphia, Pennsylvania.—With reference to the question of marginal ulcer, in my experience it has occurred in 2 per cent. of the cases. In my experience 80 to 90 per cent. of patients operated for ulcer remain well. I believe with Dr. Mayo the influence of linen thread is bad. I have met with dangling thread in the gastro-enterostomy opening at the site of the ulcer. In these cases we have abrasion, infection, necrosis, ulceration, the latter being precipitated, if not being caused, by overflowing corrosive gastric juice. Dr. Horsley's paper I enjoyed very much. I was rather startled at what he said with regard to jejunal ulcer. I did not know there were so many ulcers independent of posterior gastro-enterostomy. However, I have not looked up the literature on the subject. Dr. Finney as usual is a pathfinder. He comes out with a new field for pylorospasm, and I am sure we have been greatly interested in and pleased with what he has said.

Dr. Stephen H. Watts, Charlottesville, Virginia.—I have been much interested in this discussion since I happened to write the first article on the subject ever published in English. The ulcer occurred in the jejunum of a dog upon which I had done a gastro-enterostomy several months before. I have only encountered gastrojejunal ulcer once in a series of perhaps a hundred cases, and this was opposite to the stoma. I rarely use clamps in doing a gastro-enterostomy, as I do not like to work with tissues under any tension if I can avoid it; moreover, I think postoperative hemorrhage is less liable to occur if bleeding vessels are tied with fine catgut. I should like to ask Dr. Finney whether he has ever heard of the Rammstedt type of operation being done for pylorospasm? I see no reason why it should not be done.

Dr. A. J. Ochsner, Chicago, Illinois.—In 1895 Dr. W. J. Mayo pointed out the importance of making the gastro-enterostomy opening at the lowest point of the stomach for the purpose of preventing a vicious circle. From that time on we have always made the gastro-enterostomy opening at what seemed to us to be the lowest point. In three or four cases I have met

postoperative jejunal ulcer, and in each one of those cases we found that, as a matter of fact, the opening had not been made at the lowest point, although we had intended it to be, and there was a pouch in the stomach in which evidently the acid secretion accumulated, and that it was forced against the membrane of the jejunum in quantity.

I believe that jejunal ulcer comes from the acid contents being forced against it in quantity, and I should like to ask Dr. Mayo and Dr. Horsley whether they have paid particular attention to this point, and whether in the cases in which they have encountered jejunal ulcer following gastro-enterostomy this condition did not exist. It shows very plainly on the x-ray plates of the stomach in these cases.

Dr. W. P. Carr, Washington, D. C.—There are two points I want to mention. I was much pleased several years ago to hear Dr. Mayo speak about the bad results of linen and silk stitches in the intestine and stomach, because at that time I quit using them. For the last eight or ten years I have used nothing but plain No. 2 catgut in gastro-enterostomies and in resections of the stomach, and in total extirpation of the stomach, not even chromic catgut. I have a horror of chromic catgut. We never know how long it will last or how much trouble it is going to cause. If these wounds heal at all they will be sealed firmly within two or three days, and plain No. 2 catgut will last long enough for that if we tie the knots well. That is one thing I have paid great attention to in the use of catgut—to tie three or four knots where I am at all afraid the suture may become loose.

Dr. George W. Crile, Cleveland, Ohio.—We are under obligations to the essayists this evening for what we have learned. Speaking for myself, although the mortality rate of our sections of the stomach and gastro-enterostomies has been quite satisfactory, as low as $1\frac{1}{2}$ per cent., the end-results are not satisfactory. In every case of gastric ulcer we always give an opportunity to our colleagues on the medical side to see what can be done by a fair trial of medical treatment before we operate. By doing this we have established a better relation, and we urge internists to continue medical treatment for a long time after operation. If we can get the complete coöperation of the medical and the surgical sides the two together will do far more than either one alone.

Dr. Mayo (closing the discussion on his part).—I can subscribe very heartily to what Dr. Horsley has said. I do not think that crushing with clamps or injury has much to do with the development of ulcer, otherwise we could not heal our incision because we are doing everything we can to devitalize tissue. We stop hemorrhage by inserting two or three rows of stitches, and we put on clamps three-quarters of an inch below, where we do not get ulcers. In fact, I have not seen an ulcer just in the position where I have applied clamps, and I usually use clamps if I can put them on. As to the results from operation on the obstructed stomach: Attention has been called by a great many writers on the subject of gastro-enterostomy to the fact that operation gives the best results to patients who had mechanical obstruction due to contraction. Anterior and posterior gastro-enterostomies are almost equally successful. Sutures may not be the only cause of ulcer. I have had ulcers develop since I have used catgut alone, and I do believe that formerly we missed a great many cases of gastrojejunal ulcer. I believe about 1 or 2 per cent. of gastrojejunal ulcers occur with the use of catgut and a higher percentage with silk. The point Dr. Ochsner brought up of making the gastro-enterostomy opening at the lowest point in the stomach is well taken. By opening the membrane of the transverse colon mesentery the part of the stomach that goes directly over that part of the jejunum is the point of attachment.

Dr. Horsley (closing the discussion on his part).— I think we must recognize the fact that the Sippy treatment does not cure by lessening the "acid erosion," but it brings about a cure because it lessens peristalsis. When we have much peristalsis or much movement healing is slow. One can arrange the diet of the patient so as to reduce peristalsis to a minimum and the tissues get more rest. The stomach is supplied by sensory nerves that terminate in the musculature and do not reach the mucosa. We lower the acidity by gastro-enterostomy, but Dr. Judd tells me that in the operation he does in which he excises the duodenal ulcer, where it is more than an inch from the pylorus, excellent results are obtained, and the acidity is very materially lowered through the operation and does not involve the stomach at all.

I do not suppose there is any place in the world where gastro-enterostomy is done better and with the use of catgut stitches than at the Mayo Clinic, and still they have 2 per cent. of jejunal

ulcers that they have followed up and can demonstrate, and it is more than likely there are a great many more they do not see. In addition there are doubtless often recurrent symptoms due to irritation and hyperemia of the jejunum, and while these conditions produce definite symptoms, they do not produce ulcer.

If one follows the internal medical man, he will find that these recurrence cases often go to him. These patients have been to surgeons, they have had gastro-enterostomies, they think the surgeon is at the end of his rope and the result has not been satisfactory. In many instances, after medical treatment immediately following operation, the surgeon never sees them, but it will be found if these cases could be followed up that many of them have bad results months or years afterward. That has been my own experience. The jejunum can stand almost anything for a little while, but continued insult will result in irritation. There are patients who have a high immunity. Some patients have so much resistance, so far as the jejunum is concerned, that they can stand the acid gastric juice, but they are in the minority and do not justify an unphysiological operation.

Dr. Finney (closing the discussion).—With regard to Dr. Watt's question of the Rammstedt operation, I do not see any reason why it should not work satisfactorily. I did not recommend any particular type of pyloroplasty. Dr. Horsley's method strikes me as entirely feasible and in selected cases probably will give good results. It seems to me, *a priori*, since we have hyperchlorhydria, and an overacid content of the stomach in the majority of cases, it would be well to put the pylorus out of commission, make a wide opening in order to get advantage of neutralization of the acid content by the rapid interchange which goes on between the two.

With reference to the importance of consulting with medical men in these cases, I dislike to operate on a borderline case of any kind without consulting with an internist, and particularly a case of stomach trouble. I want a competent medical man to pass it before feeling justified in operating. So I always personally work in conjunction with a competent internist. The cases reported were seen by Dr. Friedenwald. A remark made by Dr. Horsley prompts me to say what is my firm belief, namely, that gastro-enterostomy, like amputation, is always a confession of defeat. Gastro-enterostomy is never an operation of choice but always an operation of necessity.

APPENDICITIS AND THE RUBBER GLOVE

By Robert T. Morris, F.A.C.S.
New York

This paper is something that is always wanted—a minority report. When we had passed the first or heroic era of surgery and after Napoleon's surgeon in the second or anatomic era had stated that surgery had now reached its limits, that nothing remained for the student of the future excepting to acquire what was already known and to perfect his technic, we entered the third or pathologic era of surgery, the greatest one known. The pathologic era had the vices of its virtues. Surgeons felt that they must conscientiously dispose of all bacteria and their products and they paid scant courtesy to the protective resources of the individual. Now comes the fourth or physiologic era of surgery making as great a revolution as was made by the third era. The fourth era may be called the Home Rule era. The patient is turned over to his own resources as quickly as possible and with the least degree of surgery for the purpose of the moment.

One of the vices of the third era arose from the virtue of the rubber glove. The rubber glove interfered with the tactile sense and necessitated the making of longer incisions so that surgeons might work by sight. That made trouble. We put blinders on a spirited horse in order to prevent him from seeing too much. When surgeons made longer incisions they began to see too much and were tempted to do unnecessary work. Work through short incisions guided by the sense of touch requires a bit higher degree of skill but shocks the

patient less and allows him more quickly to be taken charge of by his own protective resources. There is great difficulty in separating the adhesions in a complicated case of appendicitis if the surgeon wears rubber gloves. The very nicest tactile sense is required for the neatest work in this situation.

Spallanzani blinded bats and let them fly around a room in which ropes and wires were suspended. The bats avoided these articles. Spallanzani thought it was due to the possession of a sixth sense. Cuvier said that it was not that, but a refinement of the tactile sense to such a degree that the bats appreciated the rebound of air waves from hanging obstacles. The older surgeons placed much stress upon the value of the *tactus eruditus*. The rubber glove has interfered with this. I had tests made by an expert who examined several physicians and surgeons with reference to that point. The lowering of tactile efficiency registered as low as eighty per cent. in the scale of one hundred in some individuals.

Appendicitis with abscess complication calls for rapid work through short incision if we are to get the best result. I have seen an operator remove a thick, heavy discolored adherent omentum requiring nearly thirty minutes for the procedure in a case in which five minutes' work through a two inch incision would doubtless have saved the patient's life. This patient died. The patient needed that big, thick, heavy, adherent omentum with its load of nucleins.

The longer incision allows more bacteria to fall in from the air in the course of a protracted operation than would be carried in by well prepared hands minus gloves working through a smaller incision. Culture media in Petri plates in an operating room become infected after short time exposure, no matter how clean the operating room. This being the case, we know that as many bacteria fall into the wound as would fall into the Petri plate.

In cases of irritation from old adherent appendices, working by sense of touch through a short incision gives us opportunity to disengage the appendix quickly in situations in which one

might become much confused and do much damage to surrounding structures if we were to work with gloves and aided by the sense of sight.

The rubber glove represents a distinct advance in standardized surgery and belongs to routine work; but the rubber glove has its limitations and should not be used when the interests of the patient are best served by a surgeon who is employing his best sense of touch. The rubber glove belongs to the established ritual now in surgery. Have a care that it does not do to surgery what ritual has done to religion.

FRANK MARTIN, M.D.

IN MEMORIAM

FRANK MARTIN, M.D.

1863–1920

Dr. Frank Martin was born at Brookville, Montgomery County, Maryland, on October 21, 1863, the son of James Stansbury and Lucretia Warfield Martin. His academic education was received in the Brookville Academy and in the Maryland Agricultural College, from which he was graduated with the degree of Bachelor of Science in 1884. His medical education was obtained at the University of Maryland, from which he received the degree of Doctor of Medicine in 1886. After graduation Dr. Martin was the resident physician in the University Hospital until 1892. His first faculty work was in the capacity of chief of clinic to the professor of surgery, Dr. Louis McLane Tiffany, and he was closely associated with him until Dr. Tiffany's retirement in 1902, when he took over Dr. Tiffany's private practice. Dr. Martin was also active on the teaching staff of the University of Maryland, holding the position of Clinical Professor of Surgery from 1889 until his appointment as Professor of Surgery several years ago, which position he held until his death.

Dr. Martin's influence in his teaching was due not only to his accuracy and skill, but to his personality. His students

and assistants gave him the respect due an earnest, able worker and the love merited by a man of gentleness, honesty and personal charm. Because of his keenness of vision and great ability and courage as an operator, Dr. Martin left a lasting impression on those with whom he worked. His work covered practically the whole field of general surgery, brain surgery not excepted, for in this branch his long association with Dr. Tiffany during the developmental period of Gasserian ganglion technic gave him opportunities for training equalled by few men of his time. The treatment of fractures especially interested Dr. Martin. In 1914 he published a paper, "A Word in Behalf of the Open Operation for the Proper Fixation and Repair of Fractures, with Report of Cases," in *International Clinics*; in December, 1919, his last contribution to surgery, "Repair of Autogenous Bone Grafting in Fractures of Long Bones," was read at the annual meeting of the Sonthern Surgical Association in New Orleans.

Dr. Martin was engaged in private practice from the nineties, and his training and surgical ability made him a worthy successor to Dr. Tiffany. He was visiting surgeon to the University, Saint Joseph's and the Hebrew Hospitals, Union Protestant Infirmary and the Hospital for the Women of Maryland. His diagnostic ability was exceptional. To his patients Dr. Martin was untiring in his care and attention and a source of hope and strength. Especially with children, his gentleness of manner, was indeed, a wonderful thing to see. Added to his personal charm and symphathy, such qualities made him a much beloved physician.

During the World War Dr. Martin's ability was recognized by the Surgeon-General's Office and he was commissioned Major in the Medical Corps, June 6, 1917, in the first group of surgeons selected to fill the posts of chief of surgical service after the organization of base hospitals was completed. Although Dr. Martin was fifty-four years of age and had many ties that might have prevented a less conscientious

man from entering the service, his strict sense of duty and personal obligation led him to do so. His success in the service is best expressed in the words of his commanding officer in a letter to the Surgeon-General, written before his discharge from the Army: "I desire to express my appreciation of the service he (Dr. Martin) has rendered since I have been in command. He has not only rendered excellent service as a surgeon, but has been energetic and loyal at all times, and has constantly worked for the best interest of his patients and the service in general." He served as chief of the surgical service in the base hospitals at Fort Des Moines, and Camp Dodge, Iowa, and Fort Riley, Kansas, whence he was discharged from the service on June 23, 1919. Upon his return to Baltimore, Dr. Martin resumed his private practice and teaching in the Medical Department of the University of Maryland. He died December 7, 1920, being survived by his widow, formerly Miss Elizabeth Prescott Bigelow, of Boston, and his son, Frank Martin, Jr.

The passing of Dr. Martin marks the end of a well-lived life. In the words of one of his friends: "His was a generous life that his friends appreciated; serene, untiring, capable, evenly poised and happy in all he did. Baltimore is poorer for his going; old-fashioned gentility and culture will miss their champion; the day's work will miss the healer."

CHARLES BAGLEY, JR.

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